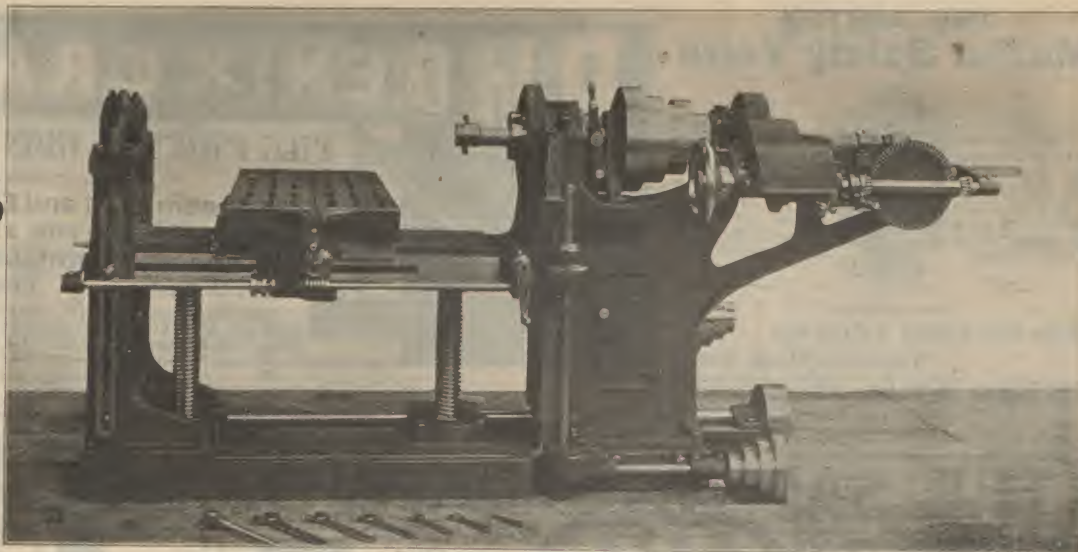


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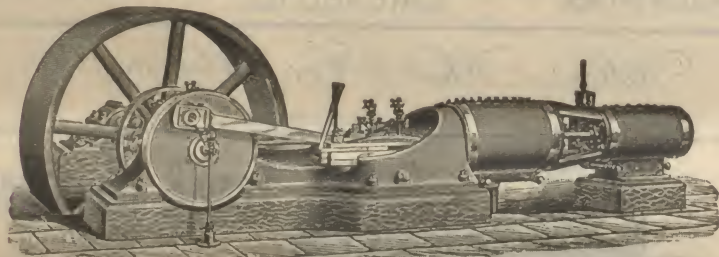
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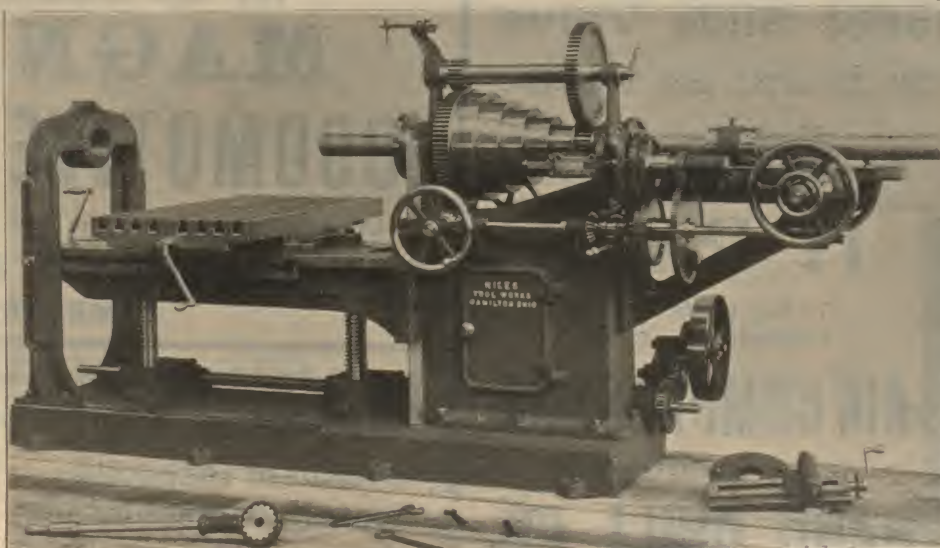
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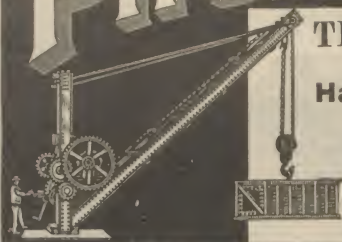
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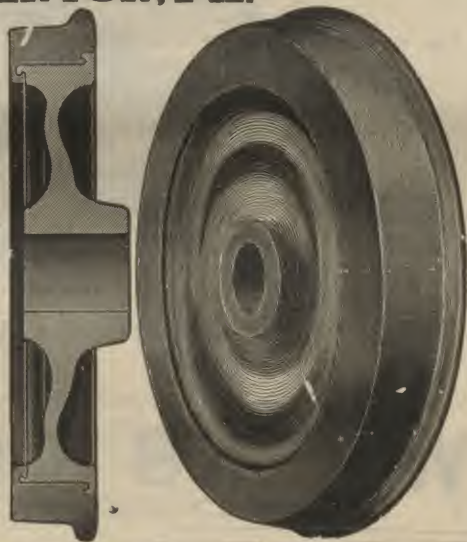
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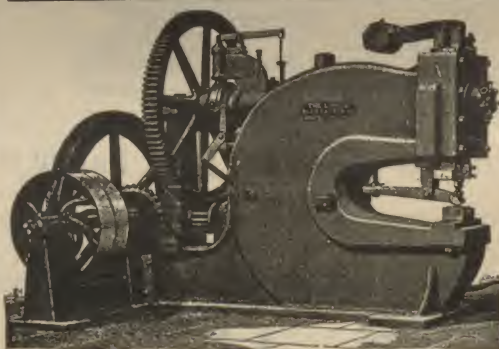


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THE RAILWAY REVIEW

No. 50

DECEMBER 12, 1896.

XXXV.

DUCTILE IRON.—An important future in the mechanical world is predicted by a writer in Engineering for the material known as ductile iron, now being introduced in this country as well as in England. Its tensile strength is represented to be 63,000 lbs. and more to the square inch, and after being heated to a dull red and plunged into cold water, it can be easily filed, showing that it takes no temper. Specimens are shown which have had portions heated and drawn out under the hammer after being twisted cold, without fracture, and a notable piece of work of the new metal is mentioned, viz: a heavy chain, of which the links were cast open, then joined and welded without the use of flux; also valve stems, crankshafts and other similar pieces, finished to pattern in a lathe and exhibiting surfaces without a blowhole, intricate castings, too, being reproduced regularly without failure, while a very high percentage of losses has attended other methods of producing very strong castings. The main question, however, is that of cost, for there are foundries that produce castings which will stand all the above tests, but without being really cheap, as is claimed for this new method.

THE CHANGING COURSE OF TRADE.—The success at the polls in New York state of the proposition to deepen the Erie canal may have been due, in no inconsiderable part, to a realizing sense of the loss to southern routes and ports of much of the export trade of the agricultural states. How rapidly the exports of grain, for instance, have been diverted from old lines of travel to new, may be judged from the following statistics: In October, 1895, New York exported 3,156,948 bushels of corn; New Orleans, 883,282 bushels; Baltimore, 788,838 bushels; Galveston 34,382. In October, 1896, New York exports of corn had fallen off over 1,500,000 bushels, reducing the city to third place as an exporter of corn, New Orleans leading with a total of 3,185,212, Baltimore being second with 2,673,815, while Galveston showed an increase of nearly 1400 per cent. In wheat, while the total for all points during the month increased nearly 100 per cent, New York's exports were diminished from 2,086,931 in 1895 to 1,948,002 in 1896, while New Orleans rose from 2,000 to 854,013, Galveston from practically nothing to 1,306,828, and San Francisco's (owing to the Indian famine probably) from 1,966,917 to 2,570,014. Only in the export of oats did New York make great gains. In the total value of all bread stuffs exported it no more than held its own, while Galveston, New Orleans and Baltimore made enormous advances.

AN ENGLISH PACIFIC CABLE SCHEME.—The Pacific Cable Committee held its first meeting for the taking of evidence at the Colonial Office, London, on November 12. Lord Selborne, one of the British delegates and chairman of the committee, presided, and there were also present Mr. G. H. Murray (the second British delegate), Sir Donald Smith and Mr. Jones (Canadian delegates), Sir Saul Samuel and Mr. Duncan Gillies (Australasian delegates), and Mr. W. H. Mercer, of the Colonial Office (secretary). The only witness examined was Mr. Sandford Fleming, C.M.G., who attended some of the preliminary meetings in the capacity of technical adviser to the colonial delegates. It has been decided that so far as future meetings are concerned no official communication will be made to the press, either as to the nature of the evidence or the identity of the witnesses examined; but with regard to the proceedings of the meeting of the 12th the Press Association states that Mr. Fleming's evidence was entirely in favor of a scheme for connecting Britain with Australasia by means of an "All British cable." Mr. Fleming is said to have been the first person to suggest a Pacific cable for the connection of Canada with the Australasian colonies; and Sir John Macdonald, to whom he communicated his ideas, submitted the scheme to Lord Beaconsfield, upon whom it is said to have made a very favorable impression. At the London conference in 1887, and at the Ottawa conference in 1894 Mr. Fleming explained his ideas on the subject, and the results have been officially published. His evidence before the committee was in precisely the same direction, and his examination by the delegates was of considerable length.

FIRE DANGER IN ELECTRIC FLEXIBLE CORDS.—The fire danger lurking in electric flexible cord connections is practically demonstrated every now and then, and with it, too, the need of better cords, says an exchange. In a recent instance mentioned in a fire underwriter's report, a flexible cord, supporting a lamp, which was not burning at the time, suddenly developed a short circuit and a one ampere fuse in a rosette opened, cutting off the current. The cord was quite greasy with oil coming from shafts and bearings, and dirty with lint which had accumulated. The risk was a cotton mill. The arc, though almost instantly cut off, was sufficient to set the cord on fire, and several inches of it was burned. The fire was quickly extinguished by an attendant, so practically no damage was done. A few days before this accident another cord developed a short circuit under practically the same conditions. In both cases the cords were hanging free in the air and had not been touched for a number of hours. It is the custom at this mill to frequently turn on and off the lamps by the key sockets, and also to frequently brush the lint off the cords. During the summer season the cords are wrapped

together and tied in a bunch near the ceiling to get them out of the way. The best explanation of the trouble is that a strand of the fine wire broke and pushed its sharp end through the insulation, causing the short circuit. Both cords had one or two layers of cotton thread first, then a fairly thick outer covering of silk, but they were not rubber covered. These occurrences show that however quickly currents may be cut off by fuses, the heat generated by the arc is sufficient to set fire to flexible cords, especially if they are all greasy and covered with lint. A better cord may not mean one having a higher insulation, but rather one which could not be set on fire. It seems important that cord should be used which would prevent short circuits occurring under as great a number of conditions as possible, and at the same time prevent the flash produced by a short circuit from doing harm.

TRAFFIC VIA THE "SOO" CANAL.—Comparative statement of commerce east and west bound through St. Mary's Falls canal, Michigan, for month of November, 1896:

EAST BOUND.

Items.	Designation.	U. S. Canal	Can. Canal	Total.
Copper.....	Net tons.....	9,241	1,133	10,374
Grain.....	Bushels.....	4,696,387	622,270	5,318,657
Building stone.....	Net tons.....	537	.....	537
Flour.....	Barrels.....	1,544,398	223,968	1,768,366
Iron ore.....	Net tons.....	341,853	84,652	426,505
Iron, pig.....	Net tons.....	4,217	2,100	6,317
Lumber.....	M. ft. B. M.....	50,122	1,282	51,404
Silver ore.....	Net tons.....	.....	.....	.....
Wheat.....	Bushels.....	7,346,331	2,608,352	9,954,683
Unclass'd frt.....	Net tons.....	13,015	3,917	16,932
Passengers.....	Number.....	148	130	278

WEST BOUND.

Items.	Designation.	U. S. Canal	Can. Canal	Total.
Coal (hard).....	Net tons.....	31,976	9,305	44,281
Coal (soft).....	Net tons.....	229,131	60,304	289,735
Flour.....	Barrels.....	.....	.....	.....
Grain.....	Bushels.....	.....	.....	.....
Manuf'd iron.....	Net tons.....	13,509	.....	13,509
Salt.....	Barrels.....	25,479	6,400	31,879
Unclass'd frt.....	Net tons.....	52,421	6,010	58,431
Passengers.....	Number.....	71	12	83

East bound freight, net tons.....1,149,639
West bound freight, net tons.....408,273

Total.....1,557,912
Total craft—United States.....1,042
Total craft—Canadian.....350

Total registered tonnage—United States.....1,109,693
Total registered tonnage—Canadian.....244,765

1,354,458

JAPANESE RAILWAYS.—The total Japanese Railway mileage on March 1, 1896, was 2,290 miles. At the same time 1,348 miles were under construction and charters have been applied for covering an additional 655 miles. A ship canal, from Osaka, across to the west coast of the Island, is also under discussion. The actual cutting would be about 22 miles, and the river Uji and 9 miles of Lake Biwa would be included in the route. The Japan Mail Steamship Co., which recently opened a line to Seattle, has established a monthly service between Yokohama and Sidney and other Australian ports, and another Australian line is projected. The annual report of the Japanese Bureau of Merchant Marine shows that Japan has registered for foreign trade 109 iron and steel steamships, of 231,139 gross tons. Since 1890 twenty shipyards have been established in Japan, and 40 were started in the previous decade. The stone drydock at Nagasaki is 438 ft. long and 26 ft. deep. The Japanese subsidy law, which went into effect last October gives shipbuilders a bounty of \$10 per gross ton on steel vessels over 1,000 tons, and grants also \$2.50 per horse power.—[Convention Report.

LUBRICATING OILS.—In an address to the Association of Mechanical Engineers at their recent meeting in Providence Mr. George R. Babbitt said that previous to the discovery of petroleum, fish oils were more generally used for lubrication than any other. About 33 years ago petroleum began to be produced in large quantities, but the world was slow to realize its value. There are few places where one cannot get better results with mineral oil than sperm oil. At the time sperm was generally used in cotton mills the spindles ran about 3,000 or 4,000 turns a minute, while now the speed is from 8,000 to 10,000. The lubricant should be adapted to the nature of the work to be done. A very heavy, slow running bearing requires an oil of density and high in viscosity, and a high fire test. Heavy, quick running bearings are best lubricated by oils of lighter gravity and high in viscosity. Light and quick running bearings are best lubricated by oils of light gravity and low viscosity. The lighter gravity oils are subject to evaporation, which may result in making them worthless. The animal oils are produced by being pressed from lard, tallow and cattle hoofs. Winter pressed oil means that the materials from which the oils are to be pressed is first chilled with ice or mechanical refrigeration, making it clear of stearine matter. This process reduces the quantity of oil that can be pressed from the animal material, and consequently the oil costs more than that known as weather made oils. Animal oils range from 23 to 24 gravity Baume at 60 deg. F., and are very low in viscosity as compared to mineral oils of the same gravity. When crude oil is taken from the ground it is of a dark red color, but in a mass it looks black or green. The oils from Pennsylvania and West Virginia are the best for lubrication. The best spindle

oils are prepared by filtering through bone charcoal. The cheaper lubricating oils are made clear by the parafe or acid process. Paraffine oils, on account of the acids used stain fabrics. Bone filtered oils are first distilled to the desired gravity, and then percolated through the bone charcoal, placed in a series of pans contained in an upright cylinder. The first oil passing through is white, but as the charcoal absorbs the coloring matter in the oil, the oil begins to show color, light at first and darker afterward. To make clear oils the charcoal must be changed each time, and they are, therefore, more expensive. They are used when the fabric manufactured on the machinery is to be bleached or dyed in delicate shades. Petroleum lubricating oils range from 22 to 40 gravity Baume at 60 deg. F., the flash point being from 300 to 400 deg. F., and their cold test from zero to 35. Cylinder oils are made from the crude after the lighter or more volatile products have been taken out. The gravity of cylinder oils ranges from 25 to 28 deg. Baume, the flash point from 450 to 580 deg. F., and the cold test from 30 to 60 deg. F. Experience has taught that a combination of mineral and animal oils makes the best cylinder lubricant.

ACETYLENE AND ITS DANGERS.—There may be a great future for acetylene as an illuminant, but foreign exchanges are of the opinion that the time when it can be used with tolerable safety has not yet arrived. In France several companies have been formed to exploit lamps and other appliances whereby the gas may be manufactured and used at home, and it has been supposed that as there is every probability of a great reduction in the cost of calcium carbide, a much cheaper and better illuminant than ordinary gas or electricity would be obtained. Scientists have approved of the use of acetylene if certain precautions were adopted, but in spite of all rules as to its use, public confidence was severely shaken a few weeks ago by two serious explosions, one at Lyons and the other at Paris. In both instances two persons were killed and several others injured. Whether acetylene is safer in the liquid or in the gaseous form is still a question among experts. It will not liquify with a less pressure than 12 atmospheres, which, however, is only about a sixth of the pressure required to liquify carbonic acid, and the latter has been used on the railways with remarkable immunity from accident. Many conflicting theories as to the nature and properties of acetylene are still exercising scientific minds and it seems clear enough that the explosive character of acetylene in any form is not yet sufficiently understood to warrant its general use as an illuminant.

NON-CONDUCTIVE GLASS.—In a recent number of the *Illustrirtes Fachblatt*, a new variety of window glass is described, invented by R. Szigmondy of Vienna, the peculiar virtue of which is its non-conductivity for heat rays. It is stated that a light of glass $\frac{1}{4}$ in. thick absorbs 87 to 100 per cent of the heat striking it, in contrast to plate glass which absorbs only about 5 per cent. This glass is to give us a window which will keep our dwellings warm in winter and cool in summer, and be especially adapted to skylights, etc., and also to blue glass spectacles for the use of furnace men. In noticing this invention it might be well to call attention to the peculiar conducting power of ordinary glass, which would seem to render Szigmondy's glass an impossibility, in some of its claims at least. If we stand by a window on which the sun shines, we may feel the warmth of the sun, but if we touch the window pane we find it cold. If we now take a light of glass and place it between us and an ordinary open fire, it will screen us from the heat, but will become rapidly heated itself. In the first case it transmitted most of the heat, and in the latter it absorbed. Plate glass may absorb but 5 per cent of sun heat, but it absorbs 94 per cent of heat from a source of 400 deg. In general, it might be stated that glass transmits the luminous heat rays and absorbs the non-luminous, and this is why a light sunshiny room is so warm in winter. The glass transmits the heat of the sun and absorbs the heat of the fire.

GOVERNMENT CONTROL OF RAILROADS.—An instructive object lesson in government control of railways has been developed by the debates in the Brazilian congress, growing out of the bill to lease the Brazilian Central to a foreign syndicate. The Central, with its branches covers 500 miles of the best coffee producing districts in the republic. The main line extends from Rio Janeiro in the north to St. Paul in the south, with an important branch west to the state of Minas. The road was built several years ago by the government at an expense of \$150,000,000, and earned for a time an income of \$16,000,000 annually, several millions of this being clear profit. Of late years, employment on the road has been given as a reward for political activity, the partisans of one party succeeding those of another with the various changes of administration. In many cases the salaries were largely disproportionate to the character of the services performed, while in nearly every case except where experts were employed, the appointees were unfit for their places. The debates in the congress, which disclosed these facts, also showed conclusively that the road instead of being a paying investment is steadily losing money at the rate of \$2,000,000 a year. Through the new president, Senhor Pereira, who was elevated on the 10th ult. from the vice presidency to the position of chief magistrate of the republic, by reason of the temporary retirement from office of President Moraes, the unsatisfactory service of the road was brought to the attention of the congress, with a strong recommendation that it be placed in the hands of private parties. It appears that a syndicate has been formed in London which will pay the Brazilian government \$90,000,000 for a 90 year lease of the road, the latter with all im-

provements to revert to the republic at the end of that period. The syndicate is entirely satisfied from an examination of the road that not only will its earnings enable it to pay the Brazilian government \$1,000,000 a year for the use of the road, but that it will still leave a handsome profit. The bill has already passed the lower house and is now in the senate, where late advices from Rio Janeiro state it will be also favorably acted upon. As a result of its passage through one branch of congress, the rate of foreign exchange has already materially decreased. It is believed, if the pending arrangement is satisfactorily concluded, that all the other roads in Brazil now supported by the government at a loss as a consequence of political manipulation, will also be leased to private parties either in the republic or in Europe.

A NEW COMPOSITE BRAKE SHOE.

Those who have given attention to the work of the committee on laboratory tests of brake shoes of the Master Car Builders' Association have doubtless been interested in the records which have been made by brake shoes composed of cast iron fitted with wooden inserts. Such shoes were tried by the committee and the report of the convention held at Alexandria Bay in 1895 shows that while the results were not entirely satisfactory, there were reasons for expecting that the construction might be modified and the material filling the cavities might be so selected that the burning out of the inserts might be prevented. The committee in speaking of one of the shoes with the wooden plugs, said: "The heat charred the plugs badly around the edges, and after this had taken place they did not present their entire section to the tread of the wheel; they also worked loose, and in practice would no doubt be liable to drop out when the shoe had been worn to about half its thickness." In another part of the report the committee, in speaking of the same shoe, said: "It compares very favorably with soft cast iron, but it is



FIG. 1.

hardly practicable for use in its present form;" and again, in speaking of the friction, it was said that a more uniform friction was given by this shoe than by any of the others, and it had the advantage of not giving the sudden rise in friction at the end of a stop. This latter statement is admirably borne out by the diagram submitted by the committee in its report. The statement is made that the friction was highest of all at the beginning of the stop and did not increase as rapidly as the others at the end of the stop. The committee also said: "The excessive vibrations or jerks on the pull rod also did not occur. These latter characteristics are good ones, but it is not certain whether these are due to the wooden plugs or to the softness of the iron." This report encouraged further experiments with composite shoes in which wooden blocks were used and the Composite Brake Shoe Company of Boston, of which Mr. W.W. Whitcomb is president, has been making some exceedingly interesting tests on a new form of shoe which is

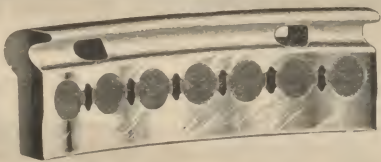


FIG. 2.

constructed under patents granted to Mr. Whitcomb. This shoe is made of cast iron and uses wooden plugs which are placed in sockets in the tread of the shoe, the purpose being to increase the retarding power without producing a gripping of the wheels. The special object of the patentee is to greatly increase the braking power and promote the retarding of the train without wearing the wheel away where the rail comes in contact with it. The experiments have been made upon locomotives and cars on several well known New England roads including the Boston & Maine Railroad. Shoes with wooden inserts have been adapted to and have been extensively used in street railway service but, as stated by the committee of the Master Car Builders' Association the ordinary wooden inserts would not withstand the excessive heat generated on the heavier trains of steam railways, experience having shown that the wooden plugs would first shrink and then drop out. In the experiments just referred to, the plugs were made of cork and it was found that this was not only a non-conductor of heat but that heat caused it to swell and expand and at the

same time the cork plugs gave better results as to friction than those which had been used previously. In making the shoes, the corks used in the inserts are originally somewhat larger than the sockets of the shoes and they are forced in and are compressed in the process and the cork being elastic is held firmly in place.

This is an interesting development and it seems to have introduced a new element into the car braking question. The accompanying illustrations shown in Fig. 1, a new driving wheel shoe before it is worn and in Fig. 2, the same shoe is shown after two months of service, the wear at the end of that time being only $\frac{1}{8}$ in., the mileage being 11,970 which was made on a fast train, making frequent stops. In Fig. 3 a new coach shoe is shown and in Fig. 4, the appearance of a shoe which has made 6,510 miles on



FIG. 3.

a locomotive tender is presented. This shoe was of course worn considerably by the stops made in switching in addition to those made with the train. With this service the shoe is not one half worn out and the cork seen to be carried out into the cavities between the plugs to a slight extent. In addition to these, other interesting samples showing the wearing qualities of the shoes are to be seen at the office of the company and among them are shoes which are entirely worn out but in which the cork plugs still remain.

One feature of this shoe which will particularly recommend it to the attention of railroad men is the fact that from the tests which have already been made, it is fair to predict that the braking of trains may be done with less pressure of air in the brake cylinders than is required with shoes giving less friction, and incident to this would be the advantage that the stresses on the levers, rods and brake beams would be decreased and the work required of the air pump will also be considerably diminished. The manufacturers state that with an engine and train of four cars equipped with these shoes, the engine runner said that he was enabled to make good



FIG. 4.

quick station stops with a reduction of from 6 to 8 pounds pressure and that he could make quicker stops with these shoes than with any that he had ever used before. He also found less excessive heating of the wheels and the shoes.

For further information, application should be made to the Composite Brake Shoe Company at Boston, or to the East Buffalo Iron Works, Buffalo, N. Y., where the shoes are also being made.

COUPLER KNUCKLES.

The decision of the United States circuit court of appeals, eighth circuit, in the case of Shickle, Harrison & Howard Iron Company, vs. St. Louis Car Coupler Company, on an appeal from the circuit court of the United States for the eastern district of Missouri, before Caldwell, Sanborn and Thayer, circuit judges to which reference was made last week is as follows:

The St. Louis Car Coupler Company, the appellee, sued the Shickle, Harrison & Howard Iron Company, the appellant, for the infringement of several patents, among others for the infringement of reissued letters patent No. 10,941, granted to Madison J. Lorraine and Charles T. Aubin, dated June 26, 1888, and original letters patent No. 519,216, granted to William V. Wolcott and Henry O'Hara, on May 1, 1894. On the trial of the case in the circuit court, the complainant below abandoned its charge of infringement, except as to the two patents last described. No reference, therefore, need be made to the other patents referred to in the bill of complaint. Both of the aforesaid patents on which the claim of infringement is predicated cover an improvement in car couplers, and counsel for the complainant below concedes, that the patented device covered by both patents consists, as an entirety, of four parts or elements. First, the draw-heads or shanks; second, the coupling head or knuckle, which is used to connect them; third, the pivot pin on which the knuckle turns, and fourth, the locking pin. All the claims of the patents are of the class known as combination claims, in which the several parts of the device are claimed in combination in several different ways. In no instance is any one part or element of the complete coupler claimed by itself, as a new article of manufacture, or otherwise, but each claim is founded upon a combination of three or more of the aforesaid elements. Usually three parts or

elements of the device are brought into combination by the language of a claim. Counsel for the complainant below further admits that the proof at the trial did not show that the defendant had either manufactured or sold, or offered to sell the complete coupler. He claims, however, and of that fact there is no doubt, that the defendant has manufactured and sold that part of the device, which in the specifications is termed, the "coupling head." This part of the device may be aptly called the "knuckle," and it will be referred to hereafter by that name. It is accordingly insisted that the manufacture and sale of that part of the device, without the consent of the complainant, constitutes an infringement of the patents.

The proof shows without substantial contradiction, that the knuckles which have been manufactured and sold by the defendant company were manufactured and sold by it under the following circumstances: The defendant at one time had manufactured the entire coupler covered by the patents in suit, under and by virtue of a contract with the complainant company, and the couplers thus manufactured had been sold by the complainant to various railway companies for use on their cars. After the aforesaid contract between the parties had been terminated, and the defendant had ceased to manufacture the entire coupler, it made, and at various times sold to the purchasing agents of the aforesaid railway companies, certain knuckles, which were bought by said companies, as it seems, to take the place of knuckles that had been broken. The question to be determined, therefore, upon this record, is whether the manufacture and sale of knuckles for the purpose last stated, that is to say, the sale thereof for the sole purpose of repairing broken couplers, to persons or corporations who had previously purchased such patent couplers from the complainant, and were entitled to use them on their cars—constitutes, in law, an infringement of the patents. The decision of the question turns on the further inquiry whether the purchase of new knuckles by said railroad company, and this substitution of the same in place of other knuckles that had been worn out or broken, amounted to a reconstruction or a repair of the couplers which were then in use. If the respective railroad companies who had bought couplers which were covered by the patents in suit, had a right to repair them to the extent of replacing knuckles that had been broken, then it is obvious that they had the right to employ the defendant company to make the knuckles for that purpose, and the latter company incurred no liability by so doing.

The rule is well established that one who purchases a machine or mechanical contrivance, consisting of several distinct parts, which, as a whole, is covered by a patent, has the right, by virtue of his purchase from the patentee, to repair a part of the machine or device which happens to be broken through accident, or which becomes so far worn as to render the machine inoperative, provided the machine, as a whole, still retains its identity, and what is done in the way of rendering it operative, does not amount to reconstruction; and provided further, that the part so replaced, is not separately covered by a patent. The sale of a patented article by the patentee, frees it from the grasp of the monopoly, and the purchaser may thereafter exercise the same dominion over it which he exercises over his other property. The right to thus repair a patented device is incidental to ownership; the fact that it is patented does not lessen the owner's right to put it in order when it gets out of repair, unless, considered as a whole, it is worn out and useless. When a patented machine is accidentally destroyed, or when it is practically worn out, the owner thereof, under the guise of repairing it, cannot make a new machine. In such cases he must cast it aside and buy a new one from the patentee. [Citations omitted.] While the foregoing propositions are well settled, a difficulty is sometimes encountered in applying them. It is not always easy to determine whether the replacing of a part or element of a patented machine, should be regarded as a reconstruction of the machine, or simply as a repair which does not destroy its identity. This remark is applicable in a measure to the case in hand. It may be conceded that the question to be decided is not altogether free from doubt. While no one would deny that a purchaser of one of the patent couplers, now in question, would have the right to replace the pivot pin or the locking pin, if one of these should happen to be broken, yet it may be admitted that it is not so obvious that he would have the right to replace a broken knuckle. The circuit court concluded that the manufacture and substitution of new knuckles for those which had been broken, should be regarded as a reconstruction of the car coupler, rather than a repair. It was led to entertain this view, as it seems, because it regarded the knuckle as the chief element of the patented combination; also because the knuckle is unique in form and structure, and only susceptible of use in connection with the other elements of the complainant's device. It is undoubtedly true that the patentee did display considerable ingenuity in devising the peculiar shaped knuckle; it is also true that the knuckle is an important element of the coupling device in question, and that it is utterly useless, except in combination with the draw-heads forming the coupler. But we are not able to say, that for these reasons, the substitution of new knuckles for others that had been broken, should be regarded as a reconstruction of the coupler. Other considerations, we think, are entitled to greater weight. The knuckle, or coupling head, as it is termed in the patent, is an irregular hook-shaped piece of cast iron or steel, which is interposed between the draw heads or shanks of the car coupler, and is perforated with holes in which to insert the locking pin and pivot pin. Owing to its position between the draw-heads, it frequently receives a severe blow or shock when, in the act of coupling, two cars come together, besides being sub-

jected to a great strain when a train is started or is in motion. The proof shows that it is much more liable to be broken than other parts of the coupling device, and from the peculiar shape of the knuckle, and its location between the draw-heads, it seems obvious that the knuckle will be broken frequently while the draw-heads remain intact, and that the knuckle is, therefore, less durable than other parts of the coupler. The president of the complainant company admitted that the knuckle of the coupling device is generally the first to break, and we can readily credit his further statement that knuckles have been known to break, the first time they were used, in pulling an empty car out of the yard. Moreover, the draw-heads of the coupling device, besides being more durable than the knuckle, are also an essential part of the patented combination. It is not wholly accurate to say that the knuckle is the chief element of the combination. The draw-heads have an equally important function to perform; they are not like the draw-heads in use in the ordinary coupling device, but are of a peculiar design, being so cast as to fit or complement the knuckle and render it operative. The draw-heads are also much the larger part of the coupling device, and doubtless cost more than the knuckle. Neither can we say that the knuckle is the only part of the coupler which affords evidence of invention, for that is found in the conception of the coupler as a whole, and in the shape and arrangement of all its parts, including the draw-heads. In view of the foregoing considerations, we think that a purchaser of the patent

out, without being subject to the charge of infringement inasmuch, as it appeared that these parts of the patented combination were less durable than the other parts. In our judgment, the principle which underlies these decisions, is strictly applicable to the case at bar. The knuckle of the complainant's car coupler is shown to be less durable than the draw-heads, but no more essential to the successful operation of the coupling apparatus; the knuckle is not claimed separately, and is not, in itself, a patented article. It follows, we think, that within the rule which is deducible from the cases last cited, a person who purchases one of the patent car couplers, thereby acquires the right to replace a knuckle which happens to be broken, provided the draw-heads still remain serviceable. To that end, we think that a purchaser may either manufacture a knuckle, or procure one some else to manufacture it for his use.

It must be borne in mind, however, that the right to manufacture and sell the knuckle in question, should be confined strictly within the limits last stated. We would not be understood as deciding that the defendant company has the right to manufacture the knuckles which form a part of the complainant's device, and to sell them indiscriminately to all persons who see fit to buy them, for clearly such is not the law. We have no doubt that the defendant would be liable as an infringer, if it so happened that the knuckles by it made and sold, should be used by the purchasers in the construction of complete couplers such as

"The Concentration of Ores;" "The Arrangement of Lead Smelting Works."

Communications regarding local arrangements should be addressed to Mr. James F. Lewis, 1328 Monadnock building, Chicago. It is to be hoped that resident members and others interested in this organization will appreciate the opportunity of contributing to the success of the meeting which promises to be an interesting and valuable one.

BROOKS LOCOMOTIVES FOR JAPAN.

The accompanying illustration was prepared from a photograph of one of two locomotives which have recently been built by the Brooks Locomotive Works for Asahi Shosha, limited contractors, Osaka, Japan, who ordered through the American Trading Co. These are of the double ender type with six coupled wheels and a pony truck at each end. The water tanks are carried upon the sides of the boiler and the coal is provided for at the rear of the cab. The cylinders are 15 x 22 in., the driving wheels are 48 in. in diameter and the boiler, which is straight, is 54 in. in diameter. The fire-box slopes down toward the front and is 78 x 29 in. The tubes, 210 in number, are 1½ in. in diameter and 9 ft. 4 in. long. They are of solid drawn copper. The length of the wheel base is 23 ft. 8 in., the driving wheel base be-



LOCOMOTIVES FOR JAPAN—BROOKS LOCOMOTIVE WORKS.

coupling device should be accorded the right to replace a broken knuckle without the payment of an additional royalty, provided the draw-heads remain intact and serviceable. It can hardly be supposed that a railroad company would equip its cars with a patent coupling apparatus like the one in controversy, one part whereof is liable to be broken long before the draw-heads are worn out, unless the purchase of the coupling apparatus was made on the implied understanding that the purchaser should have the right to replace that part of the apparatus, if it was accidentally broken, without being compelled to pay further tribute to the owner of the patent. In all of its essential features, the case disclosed by the record bears a strong resemblance to several cases heretofore cited, in which the right of a purchaser of a patented device, to replace a part thereof which had been worn out, was upheld. Thus in the leading case of *Wilson vs. Simpson et al.*, 9 Howard, 109, the patent covered a planing machine, the cutters and knives of which were not as durable as other parts of the patented combination, but had to be renewed at intervals to render the planing machine serviceable. It was held that a purchaser of the machine, by virtue of his purchase from the patentee, acquired the right to renew the cutters and knives when they were worn out, and that such renewals should be regarded as a repair of the machine, which did not destroy its identity. In the case of *Farrington vs. Board of Water Commissioners of the City of Detroit*, 4 Fisher's Patent Cases, 216, the patent covered a tubular or hollow augur, for boring pump logs. Attached to the outer end of the hollow tube, and forming a part of the patented combination, were certain bits or lips, turned inward toward the center of the tube, by means of which the boring was affected. These lips were not as durable as other parts of the patented combination, but would wear out after the augur had been in use for about 40 days. It was held that the owner of the device might replace the bits or lips when they were so far worn as to be no longer fit for use. In the case of *Gottfried vs. Conrad Seipp Brewing Co.*, 8 Fed. Rep., 323, the patent involved covered a device for pitching barrels, consisting, as it seems, of a furnace, grate, ash-pit and blower pipes, by means of which a blast of hot air was driven into a barrel for the purpose of pitching it. It was ruled that a purchaser of the device had a right to renew the blower pipes, and grates of the furnace, when they were burned

are described in the complainant's patent. *Wallace & Sons vs. Holmes, Booth & Haydens*, 5 Fisher's patent cases, 37, 45. Therefore if the defendant continues to manufacture the coupling heads, or knuckles, and keeps them in stock, it must see to it that they are sold for the purpose of repairing the patent coupling device, to persons or corporations who have acquired the right to make and use them for that purpose.

The testimony contained in the present record does not show that any sales have been made by the defendant company, except to certain railroad companies, who had theretofore bought patent car couplers from the complainant or its predecessors in interest, and were entitled to use them; neither does it show that the knuckles so bought by said railroad companies were used for other purposes than to repair such couplers as were then in use. Under these circumstances it must be held that the complainant below failed to show an infringement of its patents. The decree of the circuit court is accordingly reversed, and the case is remanded to that court with directions to dismiss the bill of complaint at the complainant's cost.

American Institute of Mining Engineers.

A circular has been received from the secretary of the American Institute of Mining Engineers, announcing that the 27th annual meeting of this organization will be held in Chicago beginning on Tuesday, Feb. 16, 1897. At this meeting a special topic of discussion will be the paper by Mr. A. Sauveur, upon "The Microstructure of Steel and the Current Theories of Hardening," which was presented at the Colorado meeting. This paper presents with great clearness the existing state of investigation and theory on the subject of which it treats and thus constitutes an excellent basis for wide and comprehensive criticism and for additional contributions. Copies of Mr. Sauveur's paper will be mailed upon application to persons desiring to take part in the discussion.

In addition to the above mentioned special topic, the following subjects are announced: "The Physics of Cast Iron;" "The Magnetic Separation of Non-magnetic Material;" "Vein Phenomena;" "The Cyanide Process;"

ing 10 ft. 4 in. The weight of the locomotive in working order is 100,000 lbs., of which 2,200 lbs. are equally divided between the two trucks, leaving 78,000 lbs. for the driving wheels. The clearance is 11 ft. 10 in. high and 8 ft. wide as a maximum, the length of the turntables being 40 ft. The gage of the road is 3 ft. 6 in., the allowable weight per axle was twelve tons and the sharpest curvature to be provided for was 400 ft. radius. The locomotive is designed for burning bituminous coal, the boiler pressure being 150 lbs. The locomotives are equipped with the Chatelier water brake with driver brakes worked both by steam and by hand. The boiler covering is of one-half inch asbestos board. The head light is very small and of the Japanese pattern. The couplings and buffers are of the English type, the couplings being of the screw pattern. For convenience the chief dimensions are given in tabulated form as follows, though some of them are repeated from the foregoing:

Gage of road	3 ft 6 in
Cylinders	15x22 in
Driving wheels, diam. of	48 in
Boiler, diam. of	54 in
Fire-box, length	78 in
Fire-box, width	29 in
Grate area	14 5 sq ft
Tubes, brass, number of	210
Tubes, diam. of	1½ in
Tubes, length of	9 ft 4 in
Tubes, heating surface	894.6 sq ft
Fire-box heating surface	83.12 sq ft
Heating surface, total	977.72 sq ft
Weight, total	100,000 lbs
Weight on drivers	78,000 lbs
Weight on each truck	11,000 lbs
Boiler, radial stayed, straight top	
Radial stays, distance between centers	4x4 in
Safety valves	two 3 in. Kunkle pops
Steam pipes, copper diameter	5½ in
Exhaust nozzle	double
Smoke stack	iron, with copper top
Ash pan, fitted with side openings for cleaning	
Engine trucks	radial, swing centers
Truck wheels, diam	26 in steel tired

Truck axles, iron	journals 4 1/2 x 7 in
Piston rods	hammered steel
Guides	two bar
Piston rod and valve stem packing	metallic
Driving wheel tires	American steel, 3 in thick
Driving wheel tires, front and back pairs flanged, center pair plain	
Driving wheels	cast iron
Driving boxes	cast iron
Injectors	two Sellers No. 7
Cab, iron, with double roof, 2 in air space.	
Capacity of tank	1,200 gals
Coal capacity	2,240 lbs
Cylinder lagging	asbestos
Sand boxes	two
Bearing composition	copper 6 parts; tin 1 part

A NEW CAR DOOR.

In the RAILWAY REVIEW of November 28, a new car door was illustrated which was designated as "Waitt's Car Door," Mr. A. M. Waitt, general master car builder of the Lake Shore & Michigan Southern Railway having been one of the inventors and patentees. The accompanying engravings illustrate another good design which possesses features equally important, if not more so, than those of the one previously shown. This door provides means for

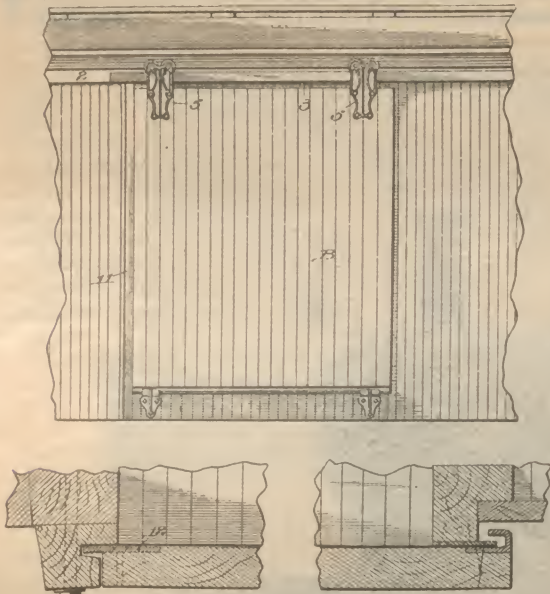


FIG. 1.

making tight or weather proof joints at the front and back ends, and these joints are also proof against cinders. Beside this the closing and locking of the door render it burglar proof, even though the bottom brackets are removed. The door when closed cannot swing out and away from the side of the car so as to strike passing trains and cause any of the serious accidents which are to be laid to many forms of doors which are hung from a top rail. This swinging cannot occur even if a hanger is removed. This is provided against without the necessity of



FIG. 2.

close fitting and without offset door brackets. The patent under consideration is the original by Mr. Waitt, and these two will make a strong combination of good features. Either of the designs would seem to meet the requirements of a good door. A door should be proof against the weather and against cinders. It should be safe from burglars and should be attached to the cars so as to prevent swinging away in such a manner as to permit of coming into contact with trains on other tracks or with fixtures along the line. In addition to this the fixtures should be simple, inexpensive and durable.

The illustrations show two sectional views and an elevation of the door, these being sufficiently clear to render a detailed explanation unnecessary. The door has a projecting lintel strip and a projecting door post with a continuous channel on its inner face and a bracket strip above and parallel with the lintel strip. The manner in which the joint is broken at the top of the door is clearly shown by the engravings. The trolley rollers are journaled on the suspension hangers and have two flanges as shown. There is a limit lug which prevents the derailment of the trolley and consequently prevents any loss or displacement of the door. The guard strips prevent the outward swing of the door when it is closed and any ordinary guide bracket may be employed. It is obvious that the trolley rollers, on account of the construction, must be entered at the rear end of the track, and that when once properly put together there is little danger of the occurrence of the mishaps which characterize many forms of doors. Owing to the arrangement of the guard and housing plates which are attached to the doorway and to the door in such a way as to bring the fastenings upon the inside and in concealed positions, these parts can be removed only by taking the door off of the car and this is especially true of the guard plate of the rear post and the sheath or U plate. Where bolts are used they can be driven out at the back end and at the bottom only by removing the door from the car. Thus it will be seen that in order to force an entrance into the car the door must be mutilated or the seal broken which would at once give evidence of having been tampered with and would probably lead to detection.

LARGE BEARING SURFACES FOR RAIL JOINTS.

The question of the relative stiffness of rails and rail joints has for a long time attracted attention and foreign technical journals have given much space to it. equal stiffness of the rail and joint being regarded as one of the main objects to be attained in the improvement of permanent way. The following is taken from a communication to Engineering by Mr. C. P. Sandberg upon the advantages of large bearing surfaces:

"This subject divides itself into two parts: First to improve the lines already laid in such a way as to avoid unnecessary disturbance of the road, and also to secure to the rail its full life before being taken up. Second in the case of laying down new lines, to adopt for them a section of the most modern type, and one most likely to give the best wearing results, at the same time reducing the cost of maintenance to a minimum.

"As to the first, many schemes have been proposed and tried to obtain a line of continuous strength by various designs of fishplates, but as all were more or less costly, complicated, and heavy, and when even by loading with deadweight the joint has come up to equal strength with the rail, they have not always given satisfaction on the road, showing that equal stiffness obtained in that way is not all that is wanted. Twenty years ago a trial was made on the Swedish State Railways with so-called deep fishplates, which gave the joint equal strength with the rail, but they did not give satisfaction, owing, probably, to the bearing surfaces between rail and fishplate being too small.

"Even to-day some of the largest railway companies

in England are giving up the use of the deep fishplates and returning to the plain section used before, and this all goes to prove that simplicity, cheapness, and lightness of design in a joint are of the greatest importance in practice.

"For maintaining the joints on roads already made the discussion has also touched on this question of increased bearings between rail and fishplate, with a view to preventing as far as possible the sinking of the joints caused by the rails and fishplates cutting into each other at their contact surfaces at the rail ends. To remedy this with the rails laid down having too small bearing surfaces, thin pieces of steel or liners have been used with more or less success to increase the life of the rails, which in many cases have to be replaced before the running surfaces are half worn out, owing to the wear at the joints by knocking.

"I circulated privately amongst my clients a paper in October, 1890, 'On Liners for the Improvement of Rail Joints,' from which the following extract is taken:

"The important question is, How to mend the present road so as to avoid rail joints knocking where the fish-plates are worn? This the platelayer has found an easy way of doing, to some extent, by applying a thin piece of old steel plate or other waste material of about 1/8 in. thickness and driving it in between the rail head and the fishplate close to where the two rails come together. As the piece of plate he uses is of equal thickness throughout and the wear at the joint is taper, the remedy is not so good as it might be if special pieces were made to suit the worn part. In order to find out the required forms I have applied pieces of lead between rail and fish on a large number of worn joints, and got at the thickness by screwing up the fishplates. The wear at the joints varies from 1/8 in. to 1/2 in., tapering away to nothing in a length of 2 in. to 4 in. from the end of the rail. Pieces of steel of this form and of varying thickness and bent at the inside to prevent them falling out could be made easily and cheaply, and would be much more effective than the makeshift pieces now used."

"After that, being convinced that greater bearing surfaces between rails and fishplates were of as much importance in securing a good durable rail joint as the stiffness of the fishplate, and as this result could not be obtained so well with my standard sections published in 1878 (of which some millions of tons had been rolled), I designed the new series of sections in 1894 with much larger bearing surfaces in every way.

"They have increased bearings between rail and sleeper by a wider flange, and between rail and fishplate and rail and tire by a wider head. This series of sections have from 20 to 40 per cent. more contact surface between railhead and fishplates than in my sections of 1878.

"The continued improvements made in the working of steel have made the rolling of sharp corners generally an easy matter, and full advantage has been taken of this in designing these new sections. The same applies to fishplates, which can now be rolled as sharp and flat as if planed in a machine. As these sections are no dearer than ordinary ones, they are fast being adopted.

"Below is a table of tests showing the comparative stiffness of rail and rail joint.

"There is, however, nothing new in these results. Tests of the same kind were published by me 20 years

TESTS SHOWING COMPARATIVE STIFFNESS OF RAILS AND RAIL JOINTS.

Weight of Rail per Yard.	Load in Tons.	Solid Rail.		Rail Joint Made with Sandberg's New Rail Sections and Angular Fishplates.										Remarks.
		36 In. Bearings.		24 In. Bearings.		20-In. Bearings.		18-In. Bearings.		16-In. Bearings.				
		D.I.	Set.	Def.	Set.	Def.	Set.	Def.	Set.	Def.	Set.			
lb.	85	25	.02	Nil	.08	Nil	Angular fishplates 21 in. long, adopted by the Imperial Railways of North China.	
		30	.03	"	.14	.04	..	..	..	..	..	..
		35	.10	"	.19	.08	.09	Nil	.08	Nil	.07	Nil		
		40	.13	.02	..	..	.11	.03	.10	.02	.08	.01
		45	.18	.07	..	..	.12	.04	.11	.03	.09	.02
		50	.30	.17	..	..	.13	.05	.11	.03	.10	.03
80	80	2517	.10	.15	.03	.13	.07	Goliath type rail joint, angular fishplates 26 in. long, adopted by the Swedish State Railway and others.	
		30	.05	Nil	.02	Nil	..	..	..	..	..	..
		35	.08	"	.05	"	..	..	..	..	..	..
		40	.12	"	.07	.02	.02	Nil	.02	Nil	.01	Nil		
		45	.14	"	.15	.06	.05	"	.04	"	.03	"		
		50	.18	.05	.18	.08	.06	.03	.05	.02	.04	"		
50	50	25	.20	.06	.21	.10	.08	.04	.07	.03	.06	.02	Angular fishplates 21 in. long, adopted by several private railways in Sweden.	
		30	.28	.10	.30	.15	.10	.05	.09	.04	.08	.03		
		12	.04	Nil	.12	.07	.01	Nil	..	..	..	..
		15	.11	"	.14	.09	.02	"	.02	Nil	.01	Nil		
		17½	.13	.01	.20	.16	.05	"	.04	"	.03	"		
		20	.22	.11	.26	.22	.09	.04	.08	.03	.07	.02		
22½	25	.45	.32	..	..	.13	.11	.12	.10	.10	.09	
		..	..	..	..	.22	.20	.20	.18	.18	.16	

ago made with plain, angular, and deep fishplates nor do these tests represent with any certainty the work the rail joint has to do on the road. But 20 years' experience has clearly proved that it is the smallness of the bearing surfaces which cut so quickly into each other that is principally responsible for the mischief of sunken joints. Therefore any increase of these bearing surfaces is of vital importance, and when they can be obtained without extra cost, why should they not be generally used? The increased weight of joint by the use of so much heavier fishplates, which act as an anvil, particularly with high speeds, is also the cause of speedy failure of the rail ends, and the heavier the fishplates the more the cutting of the bearing surfaces is likely to be. Seeing these facts, which speak rather against trying to obtain a line of continuous strength by the fishplate alone, it follows that we must gradually return to the old plan of getting the equal strength by moving the joint sleepers as closely as possible together as is compatible with leaving space for perfect packing.

"Indeed, were it not to avoid the notching of the flange rail, which would be necessary if four spikes are to be used instead of two, to prevent the creeping, there would be a great temptation to give up the use of the angular fishplate for the plain, and return to the old form of supported joint, which, with these increased bearings, would have as good a chance, or probably better, than the present suspended angle fishplate, to say nothing of saving about half the cost of fishplates, which would be ample to pay for the extra sleepers required.

"The joints in the table of the 85 lb. and 80 lbs. are of two different designs. That of the 85 lb. is of the usual standard with the fishplates 21 in. long, while that of the 80 lb. is my 'Goliath' type, with fishplates 26 in. long, as originally laid six years ago in the St. Clair tunnel on the Grand Trunk Railway of Canada, and still holding good under a heavy and severe traffic. It is also laid on a mile of the main line near Barrow side by side with the English type of road. This has also been six years in use, and has given satisfactory results. It is now adopted by the Swedish State Railways.

"The difference obtained in strength of the 80-lb. over the 85-lb. joint shows in favor of the 'Goliath' design, because of the facilities it gives of being able to arrange the relative position of the bolt and spike holes to the greatest advantage for strength and maintenance, and is well worth the extra few inches in length of fishplates.

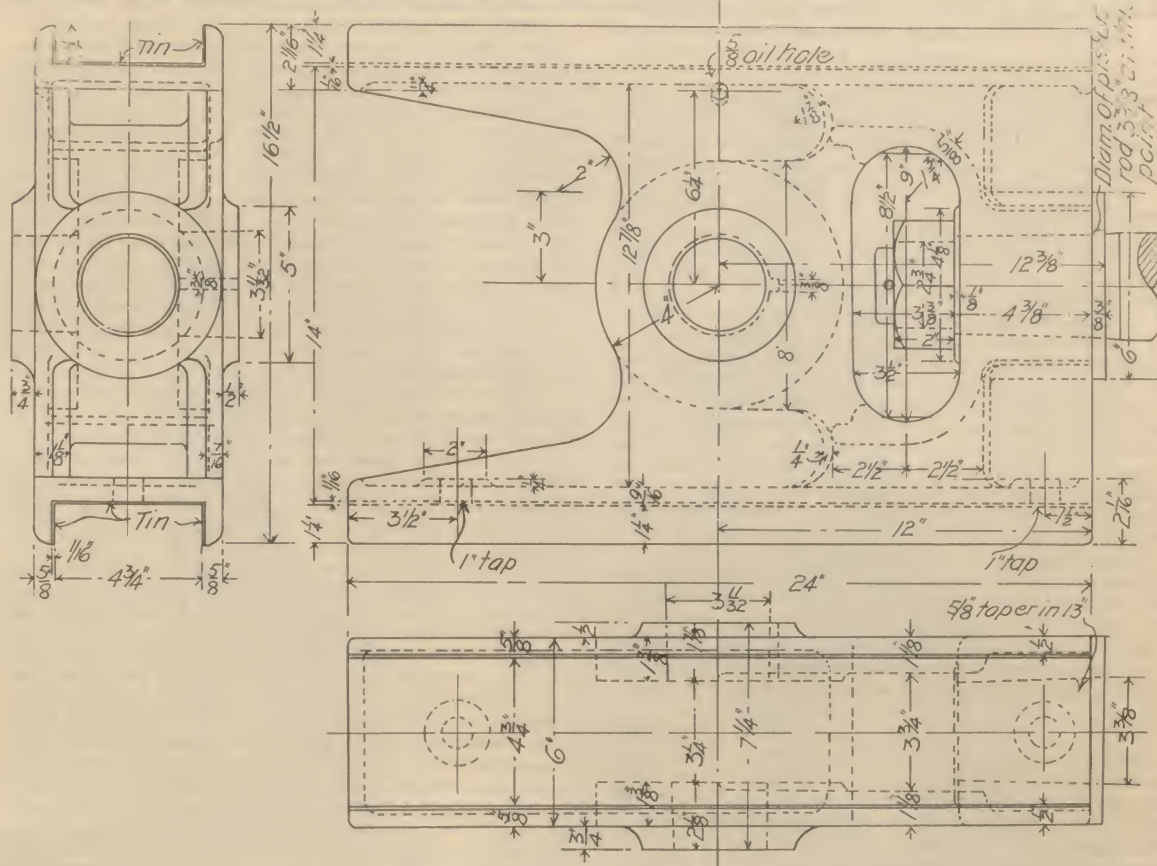
"In conclusion, the larger bearings offered by all my new sections ought to give a strong durable joint without any necessity of patching by the use of liners or complication by the introduction of deep or heavy fishplates. Of course, experience on the line over many years is the only true practical test, but no rail joint, however well designed, will give good results without reasonable maintenance and good ballast."

NEW DESIGN OF CAST STEEL CROSS-HEAD.

The great desirability of reducing the weight of the reciprocating parts of locomotives to the lowest possible limit consistent with the necessary strength, seems to be appreciated by many locomotive designers, and evidence of progress made in this direction is seen in the numerous new designs of cast steel parts such as cross-heads and pistons. A further step forward in this direction was indicated by a design for a hollow piston rod which was suggested by Mr. E. M. Herr, assistant superintendent of motive power and machinery of the Chicago & Northwestern Railway before the American Railway Master Mechanics' Association at the 1896 convention. He says: "I am of the opinion that with the proper material we can use hollow rods to good advantage * * * Much depends upon the material used in all of the efforts to secure lightness in the reciprocating parts and with the manufacture of cast steel in its present reliable condition, much greater progress is to be expected in the near future in its application to locomotive construction." The committee reporting upon the subject of reciprocating parts at the previously mentioned convention showed a number of light cross-heads of cast steel, one of which of the four bar guide type was made to weigh but 158 pounds. This cross-head, which was illustrated in the report, has been successfully used in passenger locomotives built by the Schenectady Locomotive Works and which have 19 inch cylinders working under a boiler pressure of 190 pounds. In this same report, the Pennsylvania Railroad type of cross-head for class L locomotives is illustrated, which weighs but 146 pounds, which is used in connection with a cast iron box guide. Other cross-

heads were shown weighing 150 pounds and 198 pounds, and the last one illustrated is the cross-head for the new Pennsylvania mogul locomotives for fast freight service which weighs 296 pounds.

It is comparatively easy to find cases where reductions of 100 lbs. in the weight of the cross-head have been made by the substitution of cast steel for iron, and a particularly interesting example of moderate reduction of weight is shown in the accompanying engraving, which was prepared from a standard blueprint recently received from Mr. W. H. Thomas, superintendent of motive power of the Southern Railway. This design was made at the suggestion



A LIGHT CAST STEEL CROSS-HEAD—SOUTHERN RAILWAY.

of Mr. C. F. Thomas, master mechanic of that road at Alexandria. It is a modification of the H type, and weighs complete 177 lbs., which is probably as light as a cross-head of this type can be made and used with satisfactory results. To obtain the reduction of weight over the other style used upon this road it should be stated that the former cross-head of the H type weighed 253 lbs., and the Laird cross-head 227 lbs., so that this construction shows a saving of 76 lbs. in weight over the former style of similar form and 50 lbs. saving over the Laird type. It is reported that in certain cases difficulties have been found in connection with some of the extremely light cross-heads which have been introduced recently, but from reports with regard to this one it would seem that it is entirely satisfactory in practice.

It will be noticed from the accompanying engraving that there are no shoes or gibs used in this design, but that the bearing between the cross-head and the guides is taken upon a tin lining, which is $\frac{1}{8}$ in. thick. Entirely aside from the improvement which has been secured by reduced weight, this design is of special interest on account of the form of connection which is made between the cross-head and the piston rod. The manner in which this is done is clearly shown in the engraving. The usual taper fit is employed, but instead of using a key the end of the rod is threaded and a large nut is screwed upon it, which is held from turning back in case of loosening by a cotter, which is passed through the end of the rod. This construction permits of obtaining the full strength of the rod at the end, and also of avoiding the weakening of the piston rod boss on the cross-head by cutting out a large key-way. This cross-head is used upon ten-wheeled passenger locomotives with 21x28 in. cylinders. It is a particularly neat design, and has evidently been carefully studied.

Roadmasters' Association Committees.

The secretary of the Roadmasters' Association of America has sent out the following list of subjects for the next annual convention of that organization with the names of the members of the committees appointed to report upon them:

"Best Method of Preventing Creeping of Rails." Chairman, F. J. Allen, C. B. & Q.; H. W. Church, L. S. & M. S.; A. C. Stickney, B. & M.; J. C. Hechler, D. & R. G.; John Redington, L. V.; R. A. McQuaid, B. & A.; R. N. Taylor, N. Y. C. & H. R.

"Tie Plates, the Benefits and Results Obtained from their Use." Chairman, E. E. Stone, B. & A.; J. B. Moll, C. M. & St. P.; G. N. Brown, F. & P. M.; D. H. Lovell, Penn. R.; J. A. Dodson, Southern R. R.; B. Murtaugh, N. D.; J. C. Hechler, D. & R. G.; H. P. Collins, N. Y. N. H. & H.

"Track Joints Results Obtained from Use of Various Devices." Chairman, C. E. Jones, C. B. & Q.; M. Burke, M. K. & T.; A. S. Lippert, N. Y. C. & H. R.; P. Rockwell, M. K. & T.; S. B. Bodwell, B. & M.; C. B. Lentell, D. & A.; M. Riddle, R. F. & P.; G. M. Brown, F. & P. M.; Walter A. Hill, Southern Pacific.

"Is It Most Economical to Put in Ties Out of Face or in Patches?" Chairman, F. R. Coates, N. Y. N. H. & H.

T. Hickey, M. C.; E. H. Bryant, N. Y. N. H. & H.; J. A. Taylor, N. Y. C. & H. R.; W. H. Courtney, K. & W.; M. J. Greeney, L. V.; P. Madden, C. M. & St. P.

"Latest Improvements in Frogs and Switches." Chairman, W. J. Prindle, Penna. Co.; H. G. Hetzler, C. B. & Q.; W. D. Otis, N. Y. C. & H. R.; D. H. Lovell, Penna. Co.; H. D. Hanover, B. & O. S. W.; W. H. Mautz, C. S. & H.

A paper will be presented by Mr. H. W. Church, L. S. & M. S., entitled: "Best method of directing and supervising the work of section foremen. What reports are necessary for the special information of the roadmaster to enable him to successfully direct and control the work."

SKETCH OF THE ORIGIN OF THE BESSEMER PROCESS.*

BY SIR HENRY BESSEMER.

Ever mindful of the great honors spontaneously conferred on me by the president and council of the American Society of Mechanical Engineers in electing me an honorary member of that learned body, I have deemed it both a privilege and a duty on my part to lay before them a brief account of the early origin of the Bessemer process of steel manufacture, as developed at my bronze powder manufactory in London.

It is generally well known that this invention had its origin in certain experiments commenced in January, 1855, for the purpose of improving the quality of cast iron employed for founding heavy ordnance, by rendering the iron more tough, increasing its tensile strength, and making it less subject to injury by abrasion. I was aware that Fairbairn and others had sought to improve cast-iron by the fusion of some malleable scrap iron along with the pig-iron in the cupola furnace; this fusion of scrap-iron, intermixed with the mass of coke, was found to convert the malleable iron into white cast-iron, which was at the same time much contaminated with sulphur, and thus, to a great extent, this method had failed in its object. In my experiments I avoided the difficulties inseparable from Fairbairn's plan, by employing a reverberatory furnace in which the pig-iron was fused, forming a bath; into this bath I put broken-up bars of blister-steel, made from Swedish or other charcoal iron, its fusion taking place without being further carburized by contact with the solid fuel, or contaminated by the absorption of sulphur. The high temperature necessary for the fusion of a large proportion of steel in the bath, was attained by constructing the fire grate much wider than the bath, by contracting the width of the furnace considerably at the bridge, and also by continuing to taper the furnace slightly all the way from the fire bridge to the down cast

*From a paper read before the American Society of Mechanical Engineers.

flue, which was connected with a tall chimney shaft. My English patent for this arrangement bears date January 10, 1855. Many alterations and modifications of this furnace were made from time to time; it was found that the large volume of flame sweeping over the open hearth of the furnace was mixed with a considerable quantity of combustible gas, to consume which a hollow fire-bridge was employed, having numerous perforations made in the fire clay lumps of which it was composed, and so arranged as to allow jets of hot atmospheric air to mingle with these combustible gases, which had the effect of producing an intense heat close down on the surface of the bath; it was also found that the admission of hot air all along the back of the fire-bridge produced a decarbonizing action on the bath; and hence the degree of carburization of the metal might be altered by regulating the admission of air. The flow of air through the hollow fire bridge served also to moderate its temperature and render it more durable.

I Some of the samples of metal which I produced by this process were, when annealed, of an extremely fine grain and of great strength. At this stage of my experiments I determined on casting a small model gun, which in the lathe gave shavings slightly curled, and closely resembling the turnings from a steel ingot. The metal when polished also looked white and close grained like steel. I was so well pleased with this casting that I took it over to Paris, obtained an audience with, and showed it to, the Emperor, who had, in fact, encouraged me to make an attempt to improve iron employed in founding heavy ordnance. His majesty, who had desired me to report progress, accepted this experimental gun, remarking that some day it might have a historical interest, and it was in recognition of this circumstance that his majesty, later on, intimated to me, through Colonel Belleville, his desire to confer on me the Grand Cross of the Legion of Honor, provided I could obtain permission to wear it, a privilege which our ambassadors twice refused. His majesty also gave me permission to erect my furnace at the government cannon foundry at Ruelle near Angouleme to which place I went, with proper introductions, for the purpose of arranging all the necessary details. I also sent over from England several thousand special fire bricks, etc., for the erection of the furnace.

But on resuming my further researches, after returning to London, an incident occurred which suddenly put a stop to the intended works at the Ruelle Gun Foundry, and, in fact, altered all my future plans and investigations.

The small scale on which this experimental furnace was built (viz.: a capacity of three hundredweight only) was much against my obtaining the high temperature necessary to melt a large proportion of steel in the pig iron bath. I was of course fully aware that a furnace of sufficient capacity to cast a five or a ten ton gun would produce a much higher temperature than it was possible to attain in my small furnace, and also that a forced draft, obtained by closing in the ashpit and forcing air into it, would also still further increase the temperature. That this forced draft was in my mind at the time is shown by the fact that I took out a patent for the manufacture of cast steel, dated October 17, 1855; that is, about two months after the casting of the model gun; in this patent I fully described the forcing of air by a fan into the closed ashpits of furnaces employed in the manufacture of cast steel; and it has often since occurred to me that, with the additional resources still untried, I did not act wisely in so suddenly abandoning these open-hearth experiments, in favor of an entirely different system, suggested to my mind by the incident before referred to. But with my impulsive nature and my intense desire to follow up every new problem which presented itself, I at once threw myself unreservedly into this new study, which seemed to open a way to the rapid production of bars, rails, and plates, of malleable metal direct from the blast furnace.

Before dismissing this subject it may be interesting even at this distant period to speculate on what would have been the natural outcome of the open hearth furnace experiments, had I not been so suddenly diverted from their further pursuit.

Such a furnace, with a forced draft and a capacity of ten tons, would undoubtedly have melted malleable iron or steel in a bath of pig iron, and have decarburized it to the desired extent, for I had, in fact, in this small furnace already fused steel in a bath of pig iron, on the open hearth of a reverberatory furnace, and as far back as January, 1855, I had claimed in my patent "the fusion of steel in a bath of melted pig, or cast iron in a reverberatory furnace, as herein described."

This was about ten years prior to the first patent taken out by M. Emile Martin, and now generally known as the Siemens-Martin process. This patent was obtained in England in the name of Emil Martin only, and is dated August 18, 1865, or more than ten years after my patent of January 10, 1855. M. Emil Martin, in his patent, says: "The manufacture is effected upon the principle of fusion of iron or natural steel in a bath of cast iron, maintained at a white heat, in a reverberatory furnace such as a Siemens's gas furnace."

I desire to say that I make no claim whatever to the prior invention of the Martin-Siemens process, nor do I for one moment assume that my patent of 1855 furnished any information which either of these gentlemen availed themselves of; but I think I am justified in saying that the fusion of steel in a bath of pig iron, on the open hearth of a reverberatory furnace, which I had patented and successfully effected, was, to use a favorite expression of Mr. Gladstone, "approaching within measurable distance" of that now well known and successful process.

On my return from the Ruelle Gun Foundry I resumed my experiments with the open hearth furnace, when the remarkable incident I have twice referred to, occurred in

this way: Some pieces of pig iron in one side of the bath attracted my attention by remaining unmelted despite the great heat of the furnace, and I turned on a little more air through the fire bridge, with the intention of increasing the combustion; on again opening the furnace door after an interval of half an hour, these two pieces of pig iron remained unfused. I then took an iron bar, with the intention of pushing them into the bath, when I discovered that they were merely thin shells of decarburized iron, thus showing that atmospheric air alone was capable of wholly decarburizing gray pig iron and converting it into malleable iron without puddling or any other manipulation. It was this which gave a new direction to my thoughts, and after due consideration I became convinced that if air could be brought in contact with a sufficiently extensive surface of molten crude iron the latter would rapidly be converted into malleable iron.

This, like all new problems, had a special interest for me, and I became impatient to test it by more than a laboratory experiment; without loss of time I had some fire-clay crucibles made with perforated covers, and also some fire-clay blow-pipes, which I joined to a three-foot length of one-inch gas-pipe, the opposite end of which was attached by a piece of rubber tubing to a fixed blast pipe. This elastic connection permitted the easy introduction and withdrawal of the blow-pipe into and out of the crucible. About 10 pounds of molten gray pig iron about half filled the crucible, and 30 minutes' blowing was found to convert 10 pounds of this gray pig-iron into soft malleable iron. Here at least one great fact was elicited, namely: the absolute decarburization of molten crude iron without any manipulation, but not without fuel; for had not a very high temperature been kept up in the air furnace all the time this quiet blowing for 30 minutes was going on, it would have resulted in the solidification of the metal in the crucible long before complete decarburization had been effected. Hence arose the all important question: Can sufficient internal heat be produced by the introduction of atmospheric air to retain the fluidity of the metal until it is wholly decarburized in a vessel not externally heated?

This I determined to try without delay. I fitted up a larger blast cylinder in connection with a 20 horse power engine which I had daily at work, and I also erected an ordinary foundry cupola capable of melting a half ton of pig iron. Then came the question of the best form and size for the experimental "converter." I had very few data to guide me in this, as the crucible converter was hidden from view in the furnace during the blow. I, however, found that slag was produced during the blow and escaped through the holes in the lid; this fact guided me to the construction of a very simple form of cylindrical converter, about 4 feet in height in the interior, which was sufficiently tall and capacious, as I believed, to prevent anything but a few sparks and heated gases from escaping through a central hole made in the flat top of the vessel for that purpose. The converter had six horizontal tuyeres arranged around the lower part of it; these were connected by six adjustable branch pipes, deriving their supply of air from an annular rectangular chamber extending around the converter. This is shown at the left in Fig. 1.

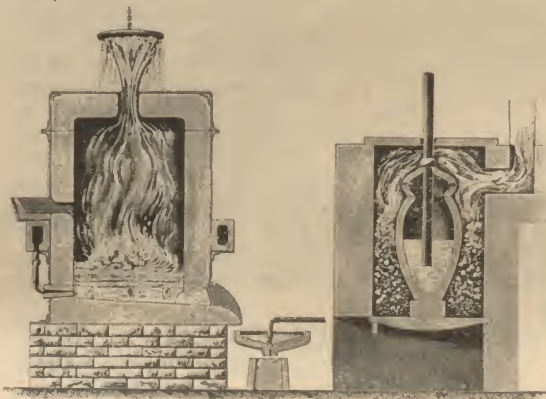


FIG. 1.—FIRST TWO FORMS OF CONVERTERS.

All being thus arranged, and a blast of ten or fifteen pounds pressure turned on, about seven hundred-weight of molten pig iron was run into the hopper provided on one side of the converter for that purpose. All went on quietly for about ten minutes. Sparks, such as are commonly seen when tapping a cupola, accompanied by hot gases, ascended through the opening in the top of the converter, just as I supposed would be the case, but soon after a rapid change took place. In fact, the silicon had been quietly consumed, and the oxygen next uniting with the carbon, sent up an ever-increasing stream of sparks and a voluminous white flame; then followed a succession of mild explosions, throwing molten slags and splashes of metal high up into the air, the apparatus becoming a miniature volcano in a state of active eruption. No one could approach the converter to turn off the blast, and some low flat zinc-covered roofs close at hand were in danger of being set on fire by the shower of red hot matter falling on them. All this was a veritable revelation to me, as I had in no way anticipated such violent results. However, in ten minutes more the eruption had ceased, the flame died down, the process was complete, and on tapping the converter into a shallow pan or ladle, and forming it into an ingot, it was found to be wholly decarburized malleable iron.

Such were the conditions under which the first charge of pig iron was converted into malleable iron in a vessel neither internally nor externally heated by fire.

I, however, desired to convert a second charge of pig iron, which had been put into the cupola, and in order to

prevent this dangerous projection upward of sparks and molten slags, a temporary expedient was resorted to, which, however, failed in its object. I procured one of those circular chequered cast iron plates so much used in the London pavements to allow coals to be put into the cellars below the pavement. This plate, which was about a foot in diameter, was suspended by a chain at a distance of eighteen inches above the central opening, in the top of the converter.

This as a mere temporary device was deemed sufficient to allow the conversion of another seven hundred-weight charge to be effected without any danger of setting fire to the premises. The converting operation went on quietly as before, but when the eruption commenced I saw the suspended plate get rapidly red hot, and in a few minutes more it melted and fell away leaving the chain dangling over the opening, and allowing the slags and splashes of metal to shoot upward as before. Thus it happened that the first converter which I had constructed was at once condemned as commercially impracticable, owing to this vertical eruption of cinder, and for this reason only. All attempts to lessen the violence of the process by a reduction of the number of tuyeres, or by lessening the diameter of the tuyere pipe orifices or by diminishing the pressure of the blast, only resulted in a reduction of the necessary temperature, and in preventing the conversion of the molten pig iron into malleable iron. In one case the trial of a diminished area of tuyere opening, resulted in nearly the whole charge of metal, after more than an hour's blowing, being converted into a solid mass of brittle white iron similar to ordinary refiners' plate metal. Indeed, I may say that the results of all my early investigations proved to me, beyond the possibility of doubt, a fact which has since been confirmed in every Bessemer steel works throughout Europe and America, viz., that rapidity of action ending in a violent eruption are absolutely necessary conditions of success; and when we take into consideration the fact that the converted metal must be made to acquire an enormously high temperature, so that it may not be chilled in tapping or pouring it out of the incandescent converter into a cold open ladle; that it be not chilled by the addition of a large quantity of much cooler metal employed to deoxidize it; that it does not chill and form a skull in the casting ladle during the comparatively long time required to form it into ingots; it is obvious that to carry out the Bessemer process successfully, a temperature must be obtained very considerably above the mere melting temperature of malleable iron. In order to obtain this temperature it is necessary to drive powerful streams of air into the metal, so as to divide it into innumerable fiery globules diffused throughout the whole body of metal under operation, which for the time being may be likened to a fluid sponge, with the active combustion of carbon with oxygen going on in every one of its myriads of ever changing cavities.

It has been found that the union of carbon and oxygen takes place so rapidly at this high temperature as to produce a series of mild explosions, which are scarcely noticed in the large converters in common use which have a space for the violent expansions, of some 8 or 10 ft. in height above the normal level of the metal; in this space the violent action expends itself unseen, and is only partially recognized by a small additional quantity of slags leaping out of the mouth of the converter.

With these facts before us it must be self-evident that all attempts to produce malleable iron in a plain cylindrical vessel which has no top to it, and in which the metal rises to within a few inches of its open mouth, must utterly fail from two causes. First, because heat would fly off so freely that the temperature of molten malleable iron could never be reached, and, second, because nearly all the metal con-

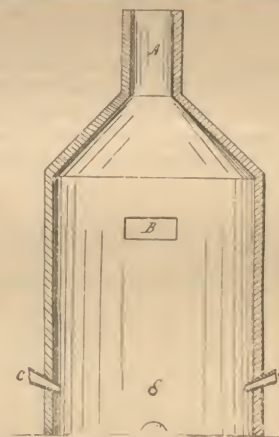


FIG. 2.—KELLEY'S CONVERTER.

tained in such a shallow open-topped vessel would leap out of it, and be scattered in all directions when the explosive eruption takes place, without which no charge of molten pig-iron can be converted into fluid malleable iron. This violent eruption of slags, accompanied by an immense volume of flame which issues from the mouth of the converter, has surprised every one when witnessing the Bessemer process for the first time. Nor was I an exception to the rule, for I was as much astonished as others at this violent eruption, or most assuredly I should never have been so stupid as to design a converter so as to discharge a shower of slag vertically upwards, and thus insure its falling back onto and all around the converter.

Till that time no one had ever seen a converter in operation, but no one who had once witnessed the conversion of fluid pig-iron into malleable iron by a blast of air, would ever propose to construct a converter with an opening at the top so as to direct this fiery stream vertically upwards. Later experience allows me fearlessly to assert

that a charge of molten crude iron cannot be converted into fluid malleable iron or steel by forcing air through it, without this violent eruption taking place. Hence it is to me utterly inconceivable that any man who had once witnessed the violent eruption invariably accompanying the converting process, should, after such an experience, design and patent a converting vessel with a sloping top and a vertical outlet so admirably adapted to throw upward and discharge so large a proportion of its contents as that shown Fig. 2, which is an exact reproduction of an authorized drawing of the converter of an American patentee who, it has been asserted, had successfully carried on this converting process many years prior to his taking out this patent in 1857. The original patent is headed: "W. Kelley. No. 505. Reissued, Nov. 3, 1857."

To be Continued.

Track Awards.

Among the railroads having a system of awards for condition of track is the Columbus, Hocking Valley & Toledo. The following announcement shows the result for the sixth year of this system which is just ended:

COLUMBUS, HOCKING VALLEY & TOLEDO RY CO.,
ENGINEERING DEPARTMENT,
COLUMBUS, O., December 5, 1896.

To Supervisors, Foremen and Section Men:

In announcing the results of the sixth annual track inspection, attention is called to the fact that the premiums are awarded for the greatest improvement resulting from the labors of trackmen during the year, proper allowance being made for the character of the rail and other materials with which they have to work. The company alone is responsible for the quantity and quality of the materials furnished, and those who have made the best use of such materials are entitled to the most credit.

It is gratifying to note that the general condition of the track has improved during the past year from an average of 78.2 per cent to an average of 80.4 per cent, a gain of 2.2 per cent. There has been a marked improvement in the condition of switches and frogs and the leads connecting them. There is, however, a tendency to neglect to some extent the condition of sidings; with the constantly increasing loads and heavy traffic, it is important that careful attention should be given to all sidings, and special care taken of such as are used for passing trains.

The awards are as follows:

- | | | |
|---------------------------|----------------|------------|
| District 1.—First Premium | - C. E. Pine | - Sect. 12 |
| Second Premium | - S. Robinson | - Sect. 11 |
| Favorable Mention | - H. Isbell | - Sect. 3 |
| District 2.—First Premium | - J. Kilbarger | - Sect. 17 |
| Second Premium | - E. Eberst | - Sect. 19 |
| Favorable Mention | - J. Moriarty | - Sect. 14 |
| | - J. Hines | - Sect. 15 |
| District 3.—First Premium | - J. McCormick | - Sect. 49 |
| Second Premium | - T. Rairdon | - Sect. 27 |
| Favorable Mention | - W. McCauley | - Sect. 46 |
| District 4.—First Premium | - P. Leary | - Sect. 43 |
| Second Premium | - F. Matthews | - Sect. 39 |
| Favorable Mention | - C. Weldon | - Sect. 36 |

District No. 2 shows the greatest improvement and the Supervisor's Premium is therefore awarded to T. Murphy.

Approved, Wm. Michel,
F. B. Sheldon, Engineer Maintenance of Way.
Chief Engineer.

MODERN IRON WORKING APPLIANCES.

VI.

POWER HAMMERS.

The group of steam hammers shown in Fig. 24, illustrates some of the designs manufactured by the Morgan Engineering Co. of Alliance O., which are particularly well adapted for railway work. In this illustration hammer No. 1 is of the single frame type and is made in sizes having the weight of the falling parts ranging from 150 to 5,000 pounds. A hammer of this type which is said to be the largest single frame hammer in this country, was manufactured by this company for the United States government and is now in use at Washington, D. C.

Hammer No. 2, is of the double stand type and the sizes in weight of falling parts range from 1,000 to 70,000 pounds. This hammer is adapted to general forging work and, as may be seen in the illustration, is provided with a link rocker arm which makes a very neat controlling apparatus and gives the operator power to instantly change the valve gear from the automatic to the hand gear, which is very desirable where single blows of great intensity are required.

The steam drop hammer as shown in No. 3, has falling parts of 4,500 pounds weight with a stroke of 48 inches, and is an unusually heavy machine for this type. These machines are manufactured in sizes varying a weight of falling parts of 400 pounds to 5,000 pounds. They are fitted with

patented adjustable guides which enable the finest adjustments to be made and the larger steel die is made separate from the anvil block in order to enable minute adjustments to be made in its location, which is an exceedingly important item in stamping work. Copper plates are inserted between the housings and the top of the anvil, and between the cylinder and the top of the housings for the purpose of eliminating as far as possible the effect of the shocks from heavy blows. The gearing and valve mechanism are designed so as to secure any desired blow at the will of the operator.

Hammer No. 4, is specially constructed for the forging of car and locomotive axles and the weight of the falling parts is 7,000 pounds the cylinder be-

hammer of this character where the work is especially severe, is usually made very heavy, being not less than ten times the weight of the falling parts and it has been found better practice to make it fifteen times the weight of the falling parts. The principal part of the block is made of steel. All of the hammers shown herewith are double acting, taking steam above and below the piston, and they can be adjusted to be entirely automatic in their action. At the will of the operator any desired force of blow can be given or any length of stroke from the minimum to the maximum can be instantly secured. Each hammer is provided with patented adjustable "V" shaped guides which enables all lost motion to be entirely taken up as wear occurs. A patented

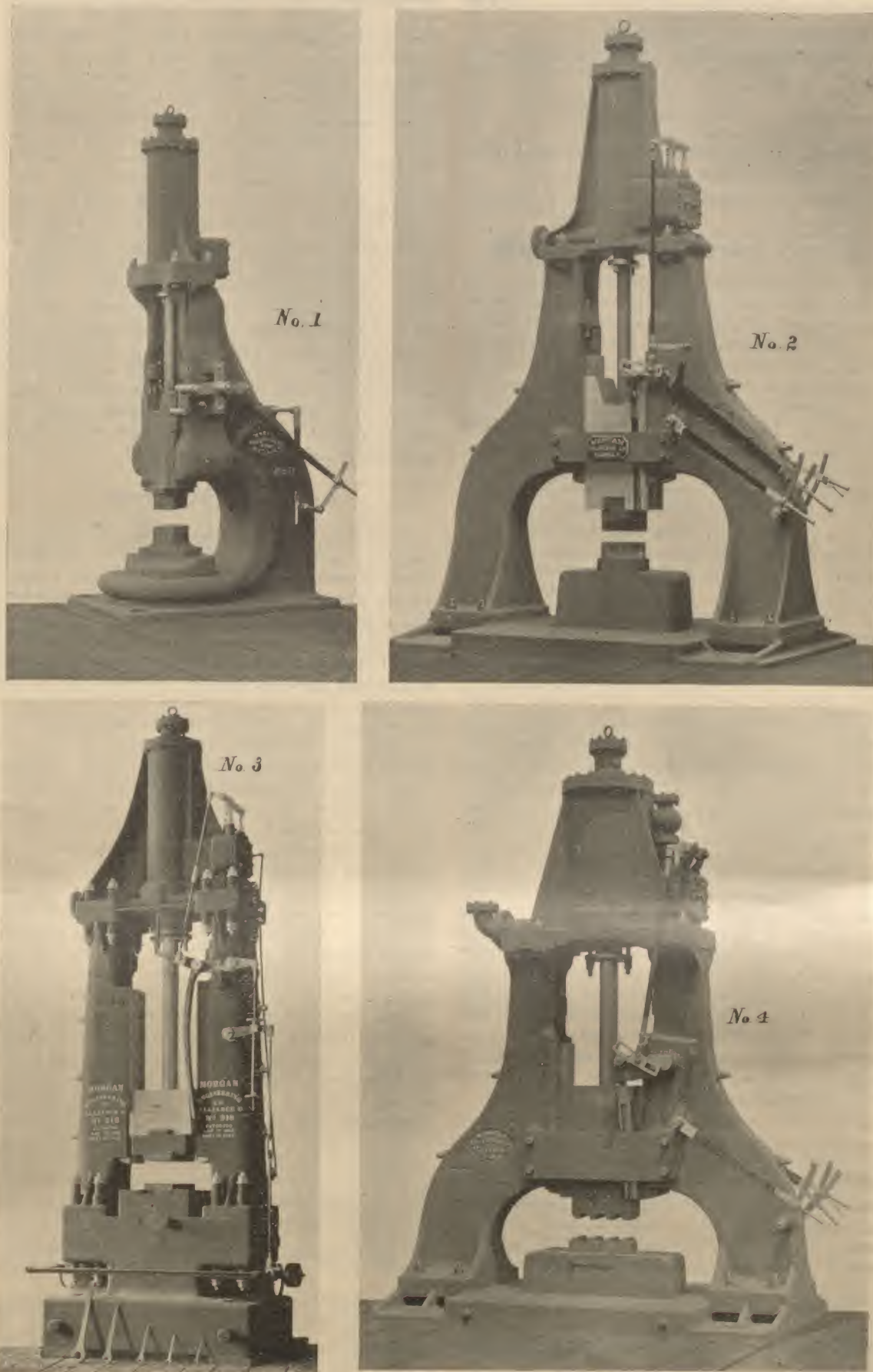


FIG. 24.—GROUP OF STEAM HAMMERS.

ing made large in diameter and given a short stroke so as to give great activity in operation. This machine is provided with a link motion rocker arm which permits of changing from automatic to hand action. The housings and bedplate are of box form and of very substantial construction. It is a machine which has been thoroughly tested by use in some of the largest manufactories. The anvil block for a

cushion cylinder head is provided in order to prevent any injury to the cylinder which might otherwise occur in case of careless handling. The pistons can be raised above the top of the cylinders for admitting new packing rings without disconnecting the rod from the ram. Each hammer built by the company is erected complete in its shops and thoroughly tested before shipment is made.

THE RAILWAY REVIEW

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CHICAGO, SATURDAY, DEC. 12, 1896.

RAILWAY managers and builders await with special interest the determination of rail makers as to 1897 prices. A price was expected several days ago. Some influential makers see it is to their interests to sell fewer rails at \$28 than more rails at \$26 or \$24 and are therefore antagonizing the policy of price modifications. The enormous rail making capacity can be fully employed again under most exceptional conditions, and it requires something more than a narrow business and selfish view to recognize that rails a few dollars cheaper which would so greatly stimulate dependent industries, would be a wise thing. The view the rail makers may take is, that when more roads and more mileage is really needed, that current asking prices will not operate against such enterprise. The billet pool seems to be dissolving again and if so it would seem that cheaper rails were certainly assured, which for general interests are desirable.

PRESIDENT CLEVELAND, in the exercise of his prerogative, has pardoned three of the railroad strikers who were sentenced to eighteen months imprisonment because of their participation in the railroad strike of '94 in California. In his notice of pardon he says that he is convinced, "these men are not criminals but laboring men who were swept into a violation of the law by first yielding to the counsels of disorder." In this statement Mr. Cleveland makes a wise discrimination, and at the same time points out the danger of attaching one's self to an organization that proposes to effect its purpose by force. That these men had any determinate intention to commit crime is not to be supposed, but they nevertheless permitted themselves to join an organization in which they were likely to be drawn into violation of law. The first duty of all citizens is the maintenance of law and order and no one therefore should support any association that in any respect countenances lawlessness.

AN opinion very prevalent in this country, and particularly in Europe, in reference to this country, is that Americans, by which is meant the people of the United States, are not over modest in estimating their ability to do almost anything under the sun. Among the more difficult tasks, running a railroad properly is very naturally conceded a high place, but as most railroad officials know, that does not deter the ordinary American from profering his advice as to methods whenever opportunity offers. Our neighbors in Canada have been generally supposed to be more conservative and to at least wait until their opinion is asked before expressing it, but if the general superintendent of the Grand Trunk Railway is to be believed, the Canadians are entitled to first place in this regard. That official recently said that since he has been in Canada he "has had more advice upon how to run a railroad than in all his life before", and his experience is anything but a short one. Perhaps it may not be amiss to suggest that in this particular case our neighbors are wast-

ing their breath, for unless he has altogether changed in character since going to the dominion the gentleman in question is not likely to highly regard unsought advice.

ALTHOUGH state railroad commissions with some few exceptions have not as yet been able to effect any marked reforms in railway operations, the New York Commission, has within the past two or three years furnished some examples of what may be done in a much needed direction. Under the law in that state the consent of the commission must be obtained before the construction of any new road can be undertaken, and to obtain such consent it is necessary to convince the commissioners that a public necessity exists. Speculative railroad building has been a curse to the country and the sooner our legislative authorities put an effectual check upon such construction, the better it will be for existing railroads and the people they are intended to serve. The New York Commissioners are to be complimented upon the wisdom with which they are administering the law. In a recent case where it was proposed to parallel an existing line the board in its decision says "The existing line is not self-sustaining, and has not been at any time since its construction. It has ample facilities to transact all the business that is offered, or which is likely to be offered for several years to come. From the applicant's own evidence it is apparent that the travel along the proposed route is not such as would make the construction of this road a public convenience and necessity as contemplated by the statutes." If these words with a veto attachment had been appended to the application for a charter of a large number of western roads, the country and the railroads traversing it would be in much better condition than at present.

PISTON ROD FASTENINGS.

The breakage of piston rods of various types at or near the crosshead fits upon locomotives has been a source of annoyance and danger, for when a piston rod lets go at the crosshead it requires the intervention of a powerful, kind providence to prevent an accident more or less serious, according to the location of the resting place of the cylinder head. Many accidents of this kind may be prevented by various improvements in the crosshead attachments such, for instance, as increasing the strength where the rod enters the crosshead by enlarging the end and adding material where rods are most likely to break. Large fillets contribute to safety and anything which tends to direct the stresses along straight lines which are parallel to the piston rod center is also a desirable precaution. Elsewhere in this issue an arrangement is shown which has been found very satisfactory upon an important road and which does away with the necessity for the key fastening of the rod in the crosshead. There are two apparently excellent reasons for desiring to dispense with the use of keys in this connection. First, the cutting away of the metal for the key weakened both the rod end and the crosshead boss into which the taper end is secured. Second, the stresses set up by the driving of a key is a matter of great uncertainty. As to the first mentioned reason, probably there will be difference of opinion as to the value of doing away the weakening effect of the key ways. Many will claim that breakages do not occur through the key way. Perhaps not, but it stands to reason that a key with a very gradual taper well driven by a heavy sledge will set up stresses in the rod which may be communicated to parts which are not far from the key seat and the influence of the key probably effects breakages which are not directly opposite that member.

The substitution of a nut for a key has another recommendation in that the turning of a nut may be nicely regulated by the employment of wrenches of certain lengths, so that it could be made impossible to strain the metal beyond its elastic limit when fastening rods in this way. It would be considered absurd to suggest that driving or other wheels should be forced upon their axles by means of a steam hammer; because of the fact that no definite knowledge would be obtained as to the amount of pressure required to force the fit. Will not the same reasoning apply to the driving of piston rod keys. If these keys are used it would seem advisable to have some

means of knowing the pressure applied upon them in forcing them home, to prevent the possible bad effects of one too many blows of the sledge. It has been suggested that this work could be done by means of a hydraulic press, which would at once make it possible to know the amount of stress put on the rod. This, however, would not be a convenient thing to use, and there seems to be no reason to think that the nut and thread method would not be entirely satisfactory.

Another method of securing piston rods is used in the construction of the new Strong balanced locomotive. The rod has a collar upon its back end which buttons in a cavity in the boss of the cross-head. The rod is turned down for about four inches just forward of this collar, and a sleeve is threaded into the cavity in the boss. It surrounds the rod, and when screwed up by means of a wrench the sleeve bears against the collar on the end of the rod to hold it in position in the cross-head. This method not only avoids the use of keys, but the rod end is not even threaded, the screw threads being entirely in the cross-head. The idea seems to be good and it is expected that it will be illustrated in a future issue of this journal. Such construction must necessarily add to the cost of fitting, but if it will save piston rods from breaking, the expense, which at the most would be only a few dollars, would be a good investment.

PASSENGER FARES.

While the discussion of railroad problems from a theoretical standpoint by the student of economics is of value by way of suggestion, there is danger that because of the professional standing of the men participating therein, undue importance will be generally given to their conclusions, particularly in view of the fact that those competent to treat of the subject from an experimental standpoint seldom take occasion to publish their views. A favorite theme with these men is passenger fares, and the almost universal treatment of the subject is an argument for lower fares based upon European practice. Among the later utterances in this direction is one by Prof. Edmund J. James of the University of Chicago, in an address before the Commercial Club of Indianapolis. Taking for his subject "The Economy in Passenger Traffic," Mr. James proceeds to show how upon the reduction of the lower class fares in Hungary, Austria and Belgium the volume of travel was greatly increased (in the first named country seventeen hundred per cent on local low class traffic). Mr. James, however, does not show, for the very good reason that the figures are probably not obtainable, how much the passenger traffic expenses were increased during the same period.

The prevalent opinion outside of railroad circles appears to be that the increased cost of transporting a large number of additional passengers is comparatively small. Prof. James says: "The railroads could carry double or treble the number of passengers without any appreciable increase in their expense." This statement is based upon statistics showing that the average train in this country with accommodations for one hundred twenty to one hundred fifty people only carries an average of forty persons. The argument would be good if people were like sheep and could be disposed of how, when and where the railroad company elects. But so long as people are allowed to choose their own trains, and which must be furnished in proportion to the number and at the times when the traffic offers, arguments based on averages are of little force. Perhaps no better illustration of the fallacy of this argument can be found than is furnished by the suburban service of the Illinois Central Railroad at Chicago. In order to accommodate this traffic it is necessary to run the trains at five minute intervals morning and evening and at ten minute intervals throughout the day. At morning and evening the trains are crowded, with many persons standing, but during the day travel is so much lighter that, as a matter of average, probably not more than fifty per cent of the train capacity for the whole day is utilized. On this basis there would seem to be abundant room for increased travel without additional cost; but as a matter of fact, the present amount of travel demands an increased outlay for both locomotives and cars as well as crews to handle them, if the people are to be

properly accommodated. The same difficulty attaches to all railroad service in this country. A material increase in the volume of travel would result in an outlay for additional facilities, and in very nearly a corresponding ratio. The prime consideration with the American people is not cost, but convenience, and they will not consent to be distributed according to rule in order to contribute to the economical operation of railroads.

But there is another and more potent reason why the examples cited by Prof. James and others of his class are wholly inapplicable to this country. The large bulk of the increased travel in European countries due to lower rates is consequent upon the comparatively short distances between large cities or trade centers. An immense population is embraced within the radius of a few miles from any of these centers; and low rates induce travel because money can be saved by trading at such points. In this country the case is altogether different. The time consumed in traversing the distances necessary to answer a similar purpose would be an effectual bar to such travel even at corresponding mileage rates. Then too, the conditions of life are widely different. Americans are a busy people. The leisure of the ordinary European is an unknown quantity in this country. Holidays so common on the continent are comparatively rare here and many persons will not observe even the few we have. To such a people a simple reduction of fare offers little inducement to travel.

Another feature, too often lost sight of by those who discuss the question, is the comparative relation of things abroad and at home. While there is a material difference in the rate of fare in Europe as compared with the United States, there is also a wide difference in the percentage that such rates bear to the incomes of the working people in both countries. The scale of living, the purchasing power of money, and the rate of earnings must be taken into consideration if a fair comparison is to be drawn in the operation of railroads. While there is no doubt unnecessary extravagance in the conduct of the passenger service in the United States and while perhaps there are some instances where railroad fares might be lowered to advantage, it is the opinion of those best qualified to judge that a general reduction of passenger rates throughout the United States or even in a single state would result in a marked diminution of net earnings. Should our conditions of life ever approach that of European countries, the case might be different. Meanwhile our well informed railroad men should not allow the true position of affairs to be misjudged and thus permit the properties under their control to be seriously damaged by unwise interference born of misinformation.

RAILWAY SCHOOLS.

The question of a railway course in the curriculum of our higher institutions has been frequently discussed in these columns. Whatever may be thought of the plan of attempting to teach any portion of railway operation in schools, the subject is worthy of consideration because of the fact that while practical experience is an absolute necessity for attaining proficiency in any department of railway service, there is much that may be learned through academic treatment which would be of assistance in almost all departments. It would be expecting altogether too much of schools to look to them for anything beyond a foundation upon which to build practically, but doubtless our operating officials and others would have been greatly assisted in their work by having studied the difficulties and problems involved before entering the service as subordinates. It would seem possible to arrange a course for any special department but the subject of the railways in general will appear very broad to anyone who will undertake even in an elementary manner, to select a list of subjects for study.

Foreigners have led us in regard to schools for apprentices wherein practical instruction is given to boys who are learning their trades in shops, and they have gone quite a distance in the direction of furnishing opportunities for technical training of engineers, maintenance-of-way officers, as well as

mechanical officers. An interesting contribution to this subject appears in the Bulletin of the International Railway Congress which consists of a note on the schools founded in Russia for the technical training of the subordinate staff of the railways, and other special services under the control of the ministry of ways and communications. This note is by Mr. Messoyedoff who was the Russian delegate to the Third International Congress of Technical Education, and which note comprises a portion of a report made to that congress some time ago.

Among the Russian schools the oldest is a special institute at St. Petersburg, founded in 1809 which has been several times reorganized. Its object is to educate engineers who are intrusted with constructing the highways and railways of the country so that they may keep pace with the constant and rapid progress made in the science of engineering, and with the ever increasing and complex demands of traffic and public safety. There are twenty-nine lower grade railway technical schools which are provided with apprentice workshops and are intended for the education of engine runners, firemen, and foremen in maintenance-of-way work. Two of these schools have been recently started in connection with Trans-Siberian Railway. Two more are to be opened soon. Besides these two classes of schools, there are three other schools which are of a more special character not applying to railway work. In all there are thirty-two secondary or low grade schools which are under the control of the government. The necessity for lower grade schools of this character is greater in foreign countries than with us, because technical education is available to a greater extent in free schools in this country than it is abroad.

About fifteen years ago, the government department of ways and communications began to improve the schools, which before that time were managed by the railway companies which had founded them and were only to a slight extent subject to the authority of the government. They were placed entirely in the hands of the government in 1886. The sons of railway employes, and if there be vacancies, other youths between fourteen and eighteen years of age are eligible to admission as first year students in these schools. Candidates are required to show certificates of five year's attendance at ordinary schools. If there is a preparatory school connected with the technical school, pupils entering it are required to have but three year's preparation in the ordinary schools. The courses given by these schools cover five years. The first three are spent in the school itself, the other two being devoted to practical work on railways with a view of teaching the students the details of special branches selected by them. During the three years of study, the following subjects are taught: religion, simple mathematics, bookkeeping, surveying, physics, telegraphy, applied mechanics, technology of woods and metals, elementary building and architecture, practical ideas of railway working and works, drawing and special trades.

These railway schools are supported by special funds provided by compulsory annual subscriptions from all the Russian railways at the rate of about twenty dollars per mile of line, and by the interest from the investment of this fund. In addition to this, fees are collected from the students at the rate of about eight dollars per annum. The finances for each school are looked after by a purser, who is selected from men in high positions in the railway service. The teachers consist of a headmaster and assistants. The management of the workshops is entrusted to men possessing technical knowledge, the selection being made with special reference to their ability to teach systematically. The salaries paid the teachers are lower than those which rule here for similar work, the highest salary for a headmaster being twelve hundred dollars per year. Pupils who have completed the three years' course receive a certificate and after completing two years more of practical work, a diploma is given them.

Much attention is given to practical application of subjects taught in the schools, for beside the two years given to the outside work, the pupils are required to take part in practical work during the summer holidays. The relations between the railways and the schools are fixed by law. The heads of the different railway departments are interested in

the progress of the schools, and the managers are expected to visit them for the purpose of assisting in making them of the utmost possible value to the railways upon which they are situated. It is worthy of note that the teaching of the elementary parts of the trades has been given by preference to professors who also understand the trades practically. "It has been found that under this tuition pupils make far more rapid progress than when they are taught by uneducated artisans who know nothing beyond the practical side of their business."

In addition to these technical schools, others are continually being started for the ordinary elementary education of the children of laborers and subordinate employes. In 1895 the teaching staff of the schools under the direction of the government consisted of 338, and during the year 1894-5, 2,405 pupils attended these schools, of which 2,194 pupils were in the special railway schools. There were 519 graduates in 1894. The total number of graduates of the special railway schools at the end of the year last mentioned was 6,259, fifty-five per cent of whom were actually in the railway service. The writer of the report referred to concludes with the following paragraph, which indicates the tendency toward advancing the character and scope of this education:

"The facts of the large number of students who are yearly completing their courses in the secondary technical schools (they already exceed 500) and of the measures taken to develop these schools and increase their number—among others the attempt to institute a few schools of a new type, somewhat more advanced than the others, which will fill in the gap between the secondary technical schools and the engineering institute mentioned at the beginning of this paper, lead us to hope that in the not distant future most of the lower technical positions, especially on railways, will be filled by men who have gone through these schools, that is, by educated and competent men of a high moral stamp."

It may be thought that these schools are of too elementary a character to be considered as contributing directly to the knowledge and experience which would ultimately fit a man for a high official railway position, but they are suggestive of the character of the training which might be given in such schools as these which are so closely in touch with the railways must necessarily contribute to a good educational foundation upon which to build. The conditions in Russia are so different from those surrounding us that the same treatment would not fit in higher technical education any more than it does in regard to the training of apprentice boys and for the same reasons. It is interesting to note the amount of progress which has been made in railway education in Russia and it is obvious that those who are interested in the application of similar ideas here have this precedent. It would be comparatively easy to add to the subjects which are treated in the Russian schools so as to qualify pupils to understand many of the problems of the business of transportation aside from the engineering technique, and perhaps such a plan would serve in this country.

THE DECIMAL GAGE FOR METALS.

The secretary of the American Railway Master Mechanics' Association recently sent out the following circular:

Under date of November 13, 1896, the secretary is advised by communication from the Association of American Steel Manufacturers, that at a meeting of that association held in New York on October 23, 1896, the following resolutions were adopted:

1. Resolved, That we, the Association of American Steel Manufacturers, endorse the decimal system as the proper standard for measuring all materials.
2. Resolved, That the secretary be requested to forward a complete copy of the committee's report, together with a copy of these resolutions, to the secretaries of the American Institute of Mining Engineers; the American Society of Civil Engineers; the American Society of Mechanical Engineers, and the American Railway Master Mechanics' Association, as an evidence of the appreciation of the work accomplished by these societies towards the establishment of the decimal system of gaging, and as a proof of the hearty co-operation of this association in this movement.

As an evidence that this endorsement of the decimal system of gaging carries considerable weight,

the following list of members of the association is given in the letter of advice to this office:

The Bethlehem Iron Co.,	Otis Steel Co., Ltd.,
Cambria Iron Co.,	Pacific Rolling Mill Co.,
Carbon Steel Co.,	Paxton Rolling Mills,
Carnegie Steel Co., Ltd.,	Park Bros. & Co.,
Catasauqua Mfg. Co.,	Passaic Rolling Mill Co.,
Central Iron Works,	Pennsylvania Steel Co.,
Cleveland Rolling Mill Co.,	Pottstown Iron Co.,
Colorado Fuel & Iron Co.,	Pottstown Iron & St'l Co.
Glasgow Iron Co.,	Reading Rolling Mill Co.
Illinois Steel Co.,	Schoenberger Steel Co.,
Jones & Laughlin, Ltd.,	Spang Steel & Iron Co.,
Lukens Iron & Steel Co.,	Worth Brothers.

GASOLINE WATER WORKS PLANT.

The illustration herewith is reproduced from a photograph of one-half of a water works plant which was installed at Dundee, Ill., nearly two years ago, and is a good illustration of one of the lines in which gas and gasoline engines are making great progress. The town referred to has about 1,600 inhabitants, and the water supply is obtained from springs which discharge into a storage reservoir of 300,000 gals. capacity. The power plant is located about 55 ft. below the level of the storage reservoir and at a distance of about 2,000 ft. therefrom. A ten inch main forms the suction through which the water flows directly to the pumps and is forced against a head of 110 ft. to a standpipe with a capacity of 100,000 gals. The plant is designed to furnish domestic service direct from the standpipe and fire service at 125 lbs. pressure direct from the pumps. The plant has been in service for nearly two years, and it is stated has proven perfectly satisfactory and has been economical in its operation. The pumping plant is in duplicate and triplex pumps having a capacity of 500,000 gals. per 24 hours are used. These are driven by Otto gasoline engines of 35 horse power and the method of gearing is clearly shown in the illustration. It will be noted that the connection between the engine and the pump is made by means of a friction clutch which allows the pump to be thrown into and out of gear for starting the engine. This plant was installed by Messrs. Henion & Hubbell of Chicago, which company is enjoying a very good business in supplying pumping plants and a general line of supplies and accessories thereto.

A SHIPPER'S VIEW OF THE INTERSTATE COMMERCE LAW.

In the Northwestern Lumberman appears an article written by Mr. C. W. Wells which is interesting as an expression of the lumber interest in respect of the workings of the interstate commerce law.

It has been nine years since congress first undertook the task of regulating the operations of the railways, and the study of these years has done little more than show the difficulty of the work then undertaken. The act of congress to regulate commerce between the states, commonly known as the interstate commerce law, was the response to a popular and very general demand that the government take some action to prevent abuses that had grown up in connection with the rate making power, whereby certain localities, or certain individuals of the same locality, were given undue advantage in freight charges.

The right of congress to regulate commerce between the states is clearly given by the constitution. The necessity of such a law, not only to protect the people from unreasonable rates, or unjust discrimination, but also for the conservation of the railroads themselves, is becoming more and more apparent every day.

In fact, the operation of the present law tends to show that minimum rates are as necessary to protect the security holders, as maximum rates are to protect the shippers. The average charge per mile for the transportation of passengers or freight is extremely low, and yet it is a curious fact that, while the charge for transportation in this country is but from one-third to one-half the charge for a like service in Europe, the rates of freight in some sections are so high as to be nearly prohibitive, and this, too, in the thickly settled section of the country.

It is this inequality of rates that seems to be the great-

est present evil, and one which as yet the roads themselves have been unable to handle satisfactorily, so that it would appear to be absolutely necessary to have some controlling power outside and independent of the roads themselves.

The intention of the interstate commerce law was good. That its result has been largely a failure is due partly to the vastness and complexity of the subject in hand and the inexperience of the framers of the law, but more because, instead of enacting a general law, creating a commission on just and stable principles and placing the whole subject under their control, congress undertook to make certain specific acts of railway operation unlawful. It followed as the logical sequence that all acts not specifically declared to be unlawful were permitted.

It created a commission to carry out the provisions of its act, but did not give them authority to enforce their decrees. The commission was formed on lines that are not in strict accord with a spirit of equity. Owing to the public character of railways, in dealing with this problem three parties must be considered: The government, which is the people acting as a whole; the public, the people in their individual capacities, and the railroads themselves.

While the railroad and shipper are most immediately concerned in each separate transaction, the fundamental and controlling power must always be the government; and this applies not only to the making of rates of trans-

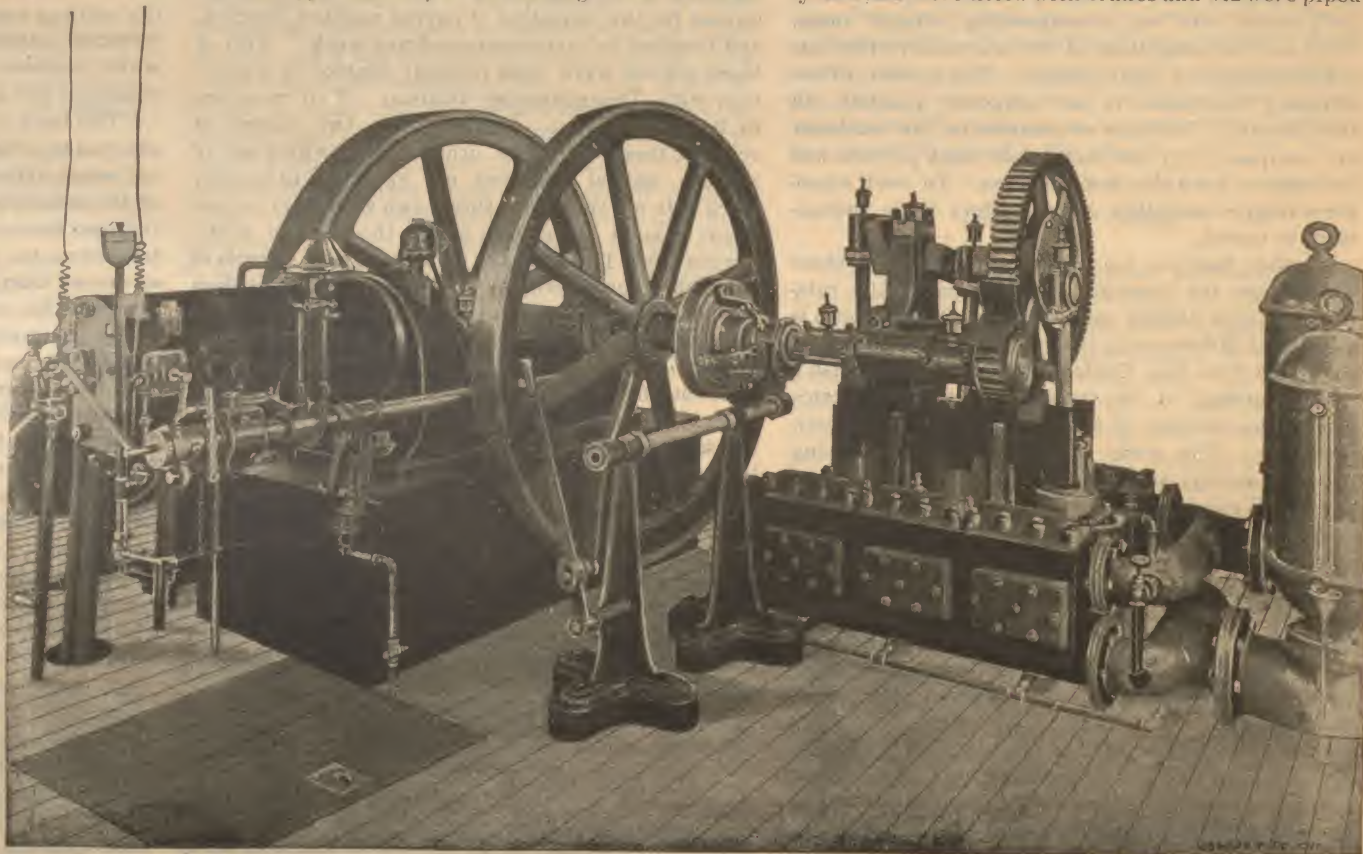
settlement of this question. These figures show that notwithstanding the many faults the railroad have been guilty of, this country has the best railway service in the world. The charge for both passengers and freight is the lowest in the world; that the wages paid are the highest in the world, but they earn less than three per cent on the capital invested. This is not a large return, and any rash or ill-advised legislation might materially reduce this.

Legislation, to be just, must protect those who own the roads as well as those that use them.

The final sentence of the article admirably sums up the case:

CONTINUOUS BRAKES IN INDIA.

The progress in equipping the rolling stock of the railways in India with air brakes does not seem to be rapid. From the returns contained in the administration report of the railways of India which has just been issued by the director general of railways, Colonel T. Gracey, R. E., it appears that up to the middle of the year a total of 2,952 cars were equipped with brakes and in addition 636 were piped. The total number of cars was 53,590, and at the end of the year 3,459 were fitted with brakes and 642 were piped.



GASOLINE ENGINE FOR WATER WORKS PLANT.

portation, but to the protection of the property itself. To obtain the best results the rights of all interests must be fully protected; the railroads as well as the shippers. To be just requires a full knowledge of the subject in hand as well as honesty of purpose.

So it would seem that the railway commission should be composed of representatives of the shipping interests, the railways, and the government. If a commission of nine members were to be appointed by the president, three on the nomination of the shipping interests, but not personally interested in business, who would know the demands of trade; three on the nomination of the railways, who would know of the ability of the roads to meet these demands, but who were not personally interested in any road; and three on the nomination of the supreme court, who would know if the agreements that the representatives of the shippers and railways might reach conformed to the law of the land, it is highly probable that better results would be obtained than under the present arrangements.

The commissioners should hold office during good behavior. Under such conditions it would seem proper to leave all details as to rates and method of operation, including the long and short haul clause, and the anti-pooling clause, to the discretion of the commission.

The commission should have final authority in all rates, both passenger and freight. In this respect, its decisions should have the force of a federal court. No charter should be granted for any new road without the approval of the commission. This country is to-day burdened by unnecessary roads, that do not now pay and may never pay, that were built simply to enrich some construction company.

In this connection it might be well to make it a criminal offense for any officer or director of any road to be interested in any way in any contract made by that company.

The present commission has rendered one very valuable service in the statistics they have collected with great care and labor. These deserve careful study. They will soften many harsh judgments against the great railway interests and go far toward a fairer and more permanent

The reason for the small increase in the number of cars equipped is undoubtedly to be found in defects in the vacuum system. The pressure type of automatic brake does not seem to have made any appreciable headway in India, and the only mention made of the Westinghouse brake is in connection with the reports from three roads. There may be more of this equipment, but it is reported in three cases only. The experience with the vacuum brake has been so unsatisfactory that it would seem necessary to substitute better apparatus for it, and if the opinion of the writer of the accompanying quotation from Indian Engineering upon the report referred to, is shared generally in India it is likely that better brake equipment may be introduced. After speaking of the returns and showing the small number of cars which are being equipped with brakes, the following comments are offered:

This must be put down as due to the unsuitability of the vacuum brake for general traffic, for the government and the railway companies are sufficiently alive to the necessity of reducing the number of accidents. At the same time, owing to the difficulty of obtaining skilled workmen, we find such cases as the following occur: In the case of an accident on the Darjeeling-Himalayan Railway the guard in charge of the train was only 20 years of age and the carriage examiner 21 years old. In men of such immature years the sense of carefulness is far from fully developed. Further there is evidence in the returns of accidents, that a very large number is due to the ordinary failing of human nature to let the performance of routine work become perfunctory, and a short succession of escapes from mishaps in spite of neglected precautions reduces the sense of danger as well as of responsibility. The human element should therefore be eliminated as much as possible. We illustrate these remarks with two examples;

1. On the Walayar Ghat of the Madras Railway an accident might have been prevented lately if the brakes of all the goods wagons had been dropped, as under the rules for

descending traffic ought to have been the case. On inquiry it proved impossible to find how many brakes were dropped.

2. The down train near Mori, Rajputana-Malwa Railway, ran into a material lorry which was being run contrary to rule on a single line after dark.

So much for human agency and the necessity of substituting suitable automatic machines as much as possible for it, but this machine ought to be really automatic and not liable to remain inactive because those who attend on it are careless. The automatic vacuum brake does not fulfil this condition. In the list of failures of the automatic(?) brake to act when called upon to do so, during the half year ending December 31 last, shows that on the East Indian Railway there were 27 failures; 19 of these were due to defective machinery, 8 to neglect of servants. On the North Western State Railway there were 25 failures; 20 due to defective machinery and 5 to neglect or inexperience of servants. On the Oudh and Rohilkand Railway the failures numbered 6; 2 due to defective machinery and 4 to neglect of servants. On the Great Indian Peninsula Railway there were 17 failures; 13 due to defective machinery and 4 to neglect of servants. The 54 which were caused by defective machinery, i. e., "failure of material" or "failure of machinery," speak for themselves and point to serious imperfections in the machine. The 21 failures caused by inattention mainly (there was only one case put down to inexperience) of servants, amount to nearly 30 per cent of the total, so that this vaunted brake is far from automatic as now worked on the Indian Railways.

(1) "The driver was unable to maintain sufficient vacuum owing to a piece of cotton waste having got in between the disc valve and the face." E. I. R., 25th July, 1895. (2) "The driver was unable to create sufficient vacuum owing to defective train connections." E. I. R. 29th October, 1895. (3) "In consequence of vacuum not having formed owing to hose pipe having been off the stopper of rear brake." N.-W. (State) Railway, 8th August, 1895. (4) "Train detained 29 minutes at Jallo on account of brake blocks sticking fast to wheels." N.-W. (State) Railway, 25th August 1895. (5) "Owing to the hose pipe not being properly put in the dummy." N.-W. (State) Railway, 17th December, 1895. (6) "Owing to piston under bogie vehicle sticking up, due probably to rolling ring having been jammed in cylinder after it was forcibly pulled down." N.-W. (State) Railway, 21st November 1895.

And there are other cases, but enough are here cited to show that the automatic nature of the brake can be nullified in countless ways; and it is high time something was done to remedy this state of affairs; or, better, the question of brakes should be opened up again with a view to letting India have the advantage of competition in this as in other matters. A supplier who has a monopoly is as likely as an ordinary employe of a company to get slack and fair competition is the only thing yet discovered to keep makers up to the mark.

Western Railway Club.

This club will hold its next regular meeting in the Auditorium hotel, on Tuesday, December 15, 1896, the meeting will be called to order promptly at 2 p. m.

The paper presented at the November meeting by Mr. J. H. McConnell, entitled "Some of the Uses and Advantages of Compressed Air" will be discussed.

Topical discussions will be held on the following subjects: "What can be Done to Further the Use of Correct M. C. B. Standards?" and "What Additional Parts of Cars is it Wise or Feasible to Standardize?"

The paper of the day will be presented by Mr. A. M. Waitt, general master car builder of the Lake Shore & Michigan Southern Railway, entitled "Suggestions on Specifications for Construction and Inspection of New Rolling Stock".

A BALANCED GAGE GLASS.

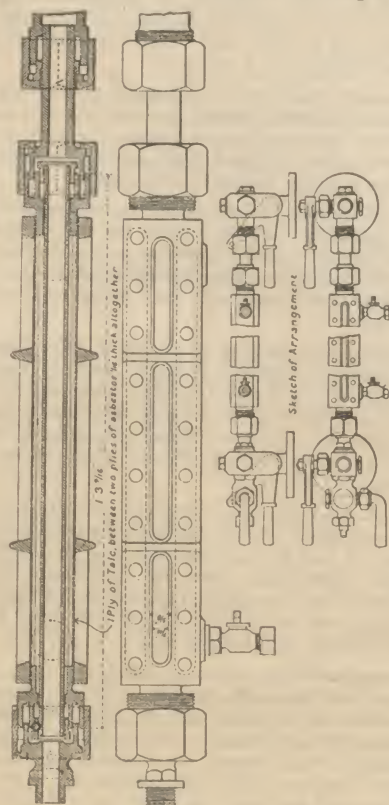
Attention has several times been called in these columns to the fact that much more care is given by foreign engineers than by us to the protection of men whose duties require them to work near steam boilers, from the painful accidents which are frequently caused by the breaking of gage glasses. The subject has recently occupied the attention of the British Board of Trade, and with the increasing of boiler pressures steps should be taken to protect these men. Several suggestions have been made as to means for accomplishing this, and one which would seem to promise effectiveness was recently described in *The Practical Engineer*, to which journal acknowledgement is given for the accompanying information and engraving.

The illustration shows a somewhat novel type of glass water gage, which is being introduced by Messrs. Watson & Sons, High Bridge Works, Newcastle-on-Tyne. The great increase of pressure that has taken place during recent years has rendered the fracture of glass water gages a matter so fraught with danger to boiler attendants, especially on board ship, that considerable attention has been devoted to improvements in the design of these fittings. A variety of devices have been proposed to obviate the trouble involved in the breaking of gage glasses, including various kinds of transparent guards to save the scattering of the fragments.

The novel feature in the gage under consideration is that the ordinary tube is surrounded by a talc

case containing live steam. The gage glass—connecting the steam and water in the usual way—is thus always in equilibrium, being enveloped with steam of the same pressure as that contained within it, and it is also protected from sudden changes of temperature, and when once inserted in its fittings it ought to last a long time. We give an outside view and a sectional elevation of the new gage, in which it will be seen that the fittings at either end of the gage glass proper, which connect it to the boiler front, are formed on the principle of a double stuffing box, the exterior of the glass having an asbestos packing around it similar to that of an ordinary slide rod. This packing at either end is kept in place by a hollow cap or gland, and is thus prevented from detaching itself from the glass, and keeps a perfectly free and open passage right through it for the steam and water.

The talc case surrounding the glass tube is supplied with dry steam from the boiler through a small



WATSON'S BALANCED GAGE GLASS.

cock at its top, while a similar cock at the bottom of the case is connected with an ordinary pipe draining into a small closed vessel, which may be emptied every watch, thus securing a dry atmosphere round the glass. The talc itself, never being in contact with the boiler water, remains transparent, and resists the highest steam pressure, thus making the gage impregnable to the usual trying conditions so detrimental to the ordinary gage glass, as high pressure, blows dealt inadvertently, cold currents of air, or water spray, do not affect it. The packing at either end of the glass requires little setting up, and there is no tendency to leakage, although the glass is practically free.

The fitting is slightly longer than the ordinary gage, to give the same visible range of water; but there is no need to provide for clearances above the cocks for inserting the glass, as the talc case can be removed at the front by simply slackening the coupling nuts, and any part can be tested or examined with the boilers at work. No objection can be raised to the jacketed tube, as should the glass happen to break, steam and water are merely transferred from inside it to the outer case.

The idea it will be seen is very ingenious, and certainly seems to be deserving of a trial. We understand that the fittings have already been tested by the Messrs. Watson, on boilers working from 160 lbs. to 170 lbs. pressure per square inch and are about to be fitted in several high class vessels now under construction.

IMPROVED PNEUMATIC HAMMER.

The Chicago Pneumatic Tool Co. has brought out a new pneumatic hammer which is known as the Chicago hammer. This tool is an improvement over those formerly sent out by the company in that the piston has one inch longer stroke and the cushioning is so perfect that there is no vibration whatever. This gives a tool which is ahead of anything we have as yet seen, as it will strike a very heavy blow and can be handled with no discomfort whatever to the operator. The old style hammer is having a heavy

sale in England, and a cable order has just been received at the Chicago office of the company for ten of the heavy size known as the large A.

NOTICES OF PUBLICATIONS.

The Practical Engineer Pocketbook for 1897. Edited by Wm. H. Fowler, Wh. Sc., M. L. Mech. E., Assoc. M. Inst. C. E., M. Iron & Steel Inst. Leather gilt with diary of ruled section paper. Technical Publishing Co., Limited, publishers of the *Practical Engineer*. Manchester, Eng., post free, 41 cents.

This is the eighth annual edition of the "*The Practical Engineer Pocketbook*," and it has increased in usefulness since the first edition, each appearance of the work being an improvement upon the preceding one. In the present issue a specially written section of valuable notes and data on mining engineering and machinery has been added which will undoubtedly prove of great value to a large number of readers. The section on electricity has been considerably enlarged by the addition of useful notes in regard to electric traction and electric welding. The statements on these subjects are concise and will be convenient for reference by those who desire to consult a convenient authority upon the present state of the art in its various aspects. The portion which refers to gas engines and oil engines has been enlarged and brought up to date and considerable attention is given to the composition of gases and the details of operation of these types of engines, a number of the different types of engines being illustrated. The most valuable feature of the work is that it is so carefully indexed as to make it possible to find the information without difficulty. In this respect, the work is especially commendable and many larger compilations of similar data are not nearly as well provided with means for finding what is wanted. The book is $3\frac{1}{2} \times 5\frac{1}{2}$ in. in size which is very convenient for the pocket. It is printed upon thin paper and while the letter press and illustrations are fair they are not remarkable in excellence, but for a practical pocket book of information it certainly fills a want and it should have a wide circulation. The annual appearance of the book and its cheapness, render it specially desirable for engineers who need something close at hand to which to refer in order to ascertain at a glance the present state of affairs in engineering lines which are constantly advancing.

On petition of the creditors of the Arena Publishing Company made October 1, 1896, before Judge Dunbar to appoint a temporary receiver, A. D. Chandler, Esq., was appointed for the protection and adjustment of the interests of the creditors during a reorganization of this company. The officers of the company did not contest the petition, feeling that it is for the best interests of all parties concerned as an equitable plan pending the business changes to be made. The Arena Company will be recapitalized by business men and placed in new hands and on a firm financial basis, the magazine to be an open court for the promulgation of all authoritative and important opinions. The business of the Arena, both as a magazine and as a book-publishing house, is reported to have had a phenomenal growth, but the company has not had sufficient capital to handle the business into which it has developed. With the reorganized company the Arena will be enabled to extend its growth and add to its reputation now so well established, in the success of which all readers and thinkers feel a personal interest on account of the national influence which this publication has attained.

TECHNICAL MEETINGS.

The annual convention of the American Society of Mechanical Engineers will be held at the house of the society 12 West Thirty-first street, New York City, December 1st to 4th, 1896. Secretary, F. R. Hutton.

The Engineers' Club of Cincinnati has a monthly meeting on the third Thursday in each month, at 7:30 p. m. at the Literary Club, 24 West Fourth street, Cincinnati, O. Address P. O. Box 333.

The Engineers' Club of Minneapolis holds its meetings on the first Thursday in each month, at Public Library building, Minneapolis, Minn.

The Engineers' Club of Philadelphia meets on the first and third Saturdays in each month, at 8 p. m., at the house of the club, 1122 Girard street, Philadelphia, Pa.

The Civil Engineers' Club of Cleveland, meets on the second and fourth Tuesdays in each month, at 8 p. m., at the Case Library building, Cleveland, Ohio.

The Association of Engineers of Virginia, holds its formal meetings on the third Wednesday of each month from September to May inclusive, at 8 p. m., at 710 Terry building, Roanoke, Va.

The Western Railway Club of Chicago, holds its meeting on the third Tuesday of each month.

The Central Railway Club meets on the second Friday of January, March, May, September and October, at 2 p. m., at the Hotel Iroquois, Buffalo, N. Y.

The Denver Society of Civil Engineers meets on the second and fourth Tuesdays in each month except July, August and December, when they are held on the second Tuesday only, at 36 Jacobson building, Denver, Colo.

The annual meeting of the Canadian Society of Civil Engineers for the election of the council for 1897, and the transaction of other business, will be held in the society's rooms, 112 Mansfield street, Montreal, on Tuesday, January 12, at 10 a. m. A supplementary circular giving details of the meeting will be issued about Dec. 15, C. H. McLeod, secretary.

The Western Society of Engineers holds its regular

meetings for the transaction of business and the reading and discussion of papers on the first Wednesday of each month except January.

The American Society of Civil Engineers holds meetings on the first and third Wednesdays in each month, at 8 p. m., at the House of the Society, 127 East Twenty-third street New York City.

The Association of Civil Engineers of Cornell University meets weekly every Friday, from October to May inclusive, at 2:30 p. m., at Lincoln Hall, New York.

The Boston Society of Civil Engineers, meets monthly on the third Wednesday in each month, at 7:30 p. m., at Wesleyan Hall, 36 Bromfield street, Boston, Mass.

The Canadian Society of Civil Engineers meets every other Thursday at 8 p. m., at 112 Mansfield street, Montreal, P. Q.

The Foundrymen's Association meets monthly on the first Wednesday of each month, at the Manufacturers' Club, Philadelphia, Pa.

The Montana Society of Civil Engineers meets monthly on the third Saturday in each month, at 7:30 p. m., at Helena, Mont.

The New England Railroad Club meets on the second Tuesday of each month, at Wesleyan Hall, Bromfield street, Boston, Mass.

The New York Railroad Club has a monthly meeting on the third Thursday in each month, at 8 p. m., at 12 West thirty-first street, New York City.

The Northwestern Track and Bridge Association meets on the Friday following the second Wednesday of March, June, September and December, at 2:30 p. m., at the St. Paul Union Station, St. Paul, Minn.

North-West Railway Club meets alternately at the West Hotel, Minneapolis, and the Ryan House, St. Paul, on the second Tuesday of each month.

The Engineering Association of the South meets on the second Thursday of each month at 8 p. m., at the Cumber and Publishing House, Nashville, Tenn.

The Railway Signaling Club holds its meetings in Chicago, Ill., on the second Tuesday of January, March, May, September and November. G. M. Basford, secretary, 818 The Rookery.

The Southern & Southwestern Railway Club holds its meetings on the third Thursday of January, April, August and November, at the Kimball House, Atlanta, Ga.

The Western Foundrymen's Association holds its meetings on the third Wednesday in each month, at the Great Northern Hotel, Chicago, Ill.; secretary, A. Sorge, Jr., 1533 Marquette building.

PERSONAL.

Mr. A. B. Browell, Jr., has been appointed claim agent of the Seaboard Air Line, vice Mr. J. W. Wilson, resigned.

Mr. C. E. Bray, general agent of the passenger department of the Chicago & Northwestern at San Francisco, retires from that position on January 1.

Mr. Robert S. Hair, traveling passenger agent of the Great Northern and Northern Steamship Company, with headquarters at Buffalo, has resigned.

Mr. A. S. Dodge has been elected vice chairman of the board of administration, Southwestern Freight Association, to succeed Mr. J. Waldo, deceased.

Mr. H. C. Eckenberger has resigned as general agent of the Chicago, Burlington & Quincy at Portland, Ore., and will be succeeded by Mr. Henry W. Goddard.

Mr. R. T. Wilson, for several years a clerk in Chairman Midgley's office, has been elected secretary of the board of administration of the Western Freight Association.

Mr. F. D. Chamberlain will hereafter have charge of the sleeping car service on the Nickel Plate road, and Mr. L. G. Johnson of the same equipment on the Lake Shore.

Mr. S. Halline has been elected secretary of the Missouri, Kansas & Texas Railway Company, vice Mr. C. G. Hedge, who assumes the duties of vice president and treasurer.

Mr. C. L. Bryvort, general yardmaster of the Baltimore & Ohio at Cumberland, has been transferred to Cincinnati as general yardmaster of the Baltimore & Ohio Southwestern.

Mr. Charles Pease, general baggage master of the Delaware & Hudson road and editor of the People's Railroad Guide, died at his home in Albany, N. Y., on Tuesday, December 1.

Mr. W. G. MacEdward, district passenger agent of the Erie, with headquarters at Huntington, Ind., will on January 1 be transferred to one of the large cities in the east to represent the Erie.

Mr. Wm. D. Vass, the oldest railway treasurer in the United States, died at Raleigh, N. C., on Monday last. He was treasurer of the Raleigh & Gaston road for fifty years, and two years its president.

Mr. J. J. Fletcher, freight traffic manager of the Kansas City, Ft. Scott & Memphis, has been appointed general traffic manager of the same company, in charge of freight, passenger and express traffic.

Mr. W. W. Daniels is to be appointed general freight agent of the Columbus, Sandusky & Hocking. Mr. C. C. Collins, who has been acting general freight agent, will be appointed assistant general freight agent.

Mr. W. D. Vincent, division operator and manager of the Pittsburgh office of the Baltimore & Ohio, has been promoted to be chief despatcher of the second and third divisions, with headquarters at Cumberland.

Mr. Charles G. Hedge, who since July, 1891, has been secretary and treasurer of the Missouri, Kansas & Texas, has resigned the position of secretary and will hereafter assume the duties of vice president and treasurer.

Mr. Frank Barr, of the Worcester, Nashua & Portland division of the Boston & Maine road, has been appointed assistant general manager of the road, vice Mr. George F. Evans, who becomes general manager of the Maine Central.

Mr. W. J. C. Kenyon, general freight agent of the Chicago, Burlington & Northern will, it is said, soon leave St. Paul for Milwaukee to take charge of the freight traffic of the Wisconsin Central, succeeding Mr. John C. Mackinnon.

It is stated that on January 1 the Queen & Crescent will establish a freight and passenger agency at Pittsburgh, and Mr. W. W. Donovan, traveling passenger agent, will represent the passenger department and Mr. C. A. Egle the freight department.

Mr. Henry B. Goodwin, of Cambridge, has been appointed by Gov. Wolcott as railroad commissioner of Massachusetts, to fill the vacancy caused by the death of Mr. William J. Dale. Mr. Goodwin is ex-president of the Boston Chamber of Commerce.

It is understood but not officially announced, that Mr. H. B. Tindell, general freight agent of the Boston & Albany Railroad, has been agreed upon as the new general manager of the Red, White & Midland fast freight lines to succeed the late Mr. George B. Sherman.

Mr. Cornelius E. Durkee, of Saratoga Springs, who for years has been connected with the passenger department of the Delaware & Hudson Co., with headquarters at Albany, has been promoted to the head of the baggage department of the road, vice Mr. Charles S. Pease of Albany, deceased.

A press dispatch from Superior, Wis., under date of Dec. 9, says: "Mr. E. T. Horn retired from the superintendency of the Lake Superior Terminal & Transfer Ry. to-day and Mr. J. D. Finn was installed as his successor. Mr. Finn was formerly superintendent of the Montana division of the Northern Pacific. Mr. Horn will go into business in Georgia."

Mr. J. E. Williams, superintendent of the Wisconsin & Michigan Railroad, has resigned his position to take effect January 1, and it is understood that the office is to be abolished. For many years Mr. Williams was manager of the Menominee and Marinette offices for the Milwaukee & Northern, and afterward with the St. Paul up to the time the Wisconsin & Michigan was incorporated.

Several changes are announced in the auditing department of the Santa Fe system. By the change the office of auditor at Topeka will be abolished and the clerks transferred to Chicago. The auditors of the various departments who remain at Topeka will report direct to General Auditor Whitehead at Chicago and the traveling auditors will in future report to Mr. I. S. Lauck, auditor of disbursements.

On Tuesday evening Mr. Edwin W. Winter, president of the reorganized Northern Pacific road, was tendered a testimonial by friends in St. Paul. This gathering was a tribute of esteem, friendship and good will, and this feeling found expression in the sincere words of many speakers during the evening. The affair occurred at the Aberdeen and took the form of a dinner at which Mr. Winter was the guest of his friends. There sat at table, beside the guest of the evening, 104 gentlemen representing every branch of the varied and complex life of a great city and section.

It is announced that the office of Captain J. F. Merry, assistant general passenger agent of the Illinois Central Railway, will be removed to Dubuque within a short time. Captain Merry is one of the most popular railroad men in the west, and has been in charge of the Central's passenger business on the western part of the system since the office was established at Manchester, Iowa, fifteen years ago. A more central location from which to operate is the reason given for the removal.

It is reported that Mr. A. J. Davidson, for some time superintendent of the Gulf, Colorado & Santa Fe lines from Cleburne to Purcell and Cleburne to Paris, has tendered his resignation, effective December 15 next. It is understood that Mr. Davidson will accept the position of superintendent of transportation of the St. Louis & San Francisco Railway with headquarters in St. Louis. Mr. Davidson has been associated with Col. B. F. Yoakum, now first vice president and general manager of the Frisco, for many years. The Frisco system embraces some 1,500 miles and with Mr. Davidson at the head of the transportation department, a good field for record making will be opened before him.

Mr. P. Ryan, superintendent of the Kalispell division of the Great Northern, died at Kalispell on the 3rd inst. of typhoid fever and pneumonia. "Paddy" Ryan, who was a well known figure in western railroading, began railroad life as a water carrier to his father, who was a section foreman on the Fergus Falls division. Then Paddy became a plain section man. He worked his way up to that unhonored position of section foreman, subsequently becoming a roadmaster. Step by step he climbed till comparatively early in life he was appointed superintendent of the Kalispell division with headquarters in Kalispell. Everybody liked "Paddy" and admired him.

There is to be, so reports from Birmingham, Ala., say a general redistricting of the southern railway lines and changing of superintendents in Georgia, Tennessee, Alabama and Mississippi on January 1. The line from Atlanta to Greenville, Miss., will, it is said, be made to com-

prise the seventh division with Mr. J. H. Barrett, now superintendent at Atlanta, as superintendent at Birmingham. The Alabama Great Southern and the Southern from Rome to Meridian, will constitute the sixth division, with Mr. A. J. Frazier as superintendent in Birmingham or Meridian. The lines from Chattanooga to Brunswick will compose the fifth division with Mr. W. R. Beauprie as superintendent either at Atlanta or Macon. A number of other official changes will, it is said, also be made when the changes begin.

RAILWAY NEWS.

Columbus Southern.—At Columbus, Ga., December 9, occurred the sale of the Columbus Southern R. The road was bought in by Messrs. J. R. Anderson of Savannah and J. R. Williams of Richmond, representing eastern bondholders and attorneys for the Georgia & Alabama Railway. The price bid was \$750,000.

Detroit, Grand Rapids & Northern.—On December 5, at Lansing, Mich., occurred the reorganization of the Detroit, Grand Rapids & Northern road, and the articles of the new organization were filed with the secretary of state under the name of the Detroit, Grand Rapids & Western, by which name it will hereafter be known. The new company includes the whole Detroit, Lansing & Northern system, and is capitalized at \$5,693,500, of which \$3,183,500 represents the preferred stock and the rest the common stock. All of the former and a majority of the latter is held by Alpheus H. Hardy, and Charles Merriam, of Boston, trustees. The other stockholders are R. Hollis Hunnewell, George Whitney, G. S. Abbott and George Shattuck, of Boston; Nathaniel Thayer, Lancaster; John A. Burnham, Manchester; F. H. Damen, Melrose; F. A. Nims, Muskegon, Mich.; Mark T. Cox, Morristown, N. J.; Charles M. Heald and J. E. Howard, Grand Rapids, Mich.

Evansville & Richmond.—The Evansville & Richmond R., which runs from Elora, Ind., to Westport, a distance of 101 miles, is to be sold by sheriff's sale sometime the last of January or first of February of next year. Up to date there are three bids filed, one by the Evansville & Terre Haute at 39 cents on the dollar, another by the Cleveland, Cincinnati, Chicago & St. Louis Co. at 42 cents and a third by the Pennsylvania Co. at 53 cents. The probability is that the Pennsylvania will get the road, and should it do so the road will be run west from Elora to Sanborn to connect with the Indianapolis & Vincennes, which is their line, and on the east extended from Westport to Rushville, where it will connect with the line in direct communication with Richmond. Should the Big Four be the lucky bidder it would be built west from Elora to Vincennes to connect with the Big Four line from Vincennes to Cairo, and on the east from Westport to connect with the Cincinnati, Indianapolis & St. Louis at Greensburg, which would give a direct trunk line from Cairo to Cincinnati.

Hoxie, Pocahontas & Northern.—The Hoxie, Pocahontas & Northern road which is 15 miles in length, is now completed and in operation. The road enters a territory which contains tracts of pine and other timber, and farms noted for their fertility. It is expected that a number of saw mill plants will be erected along the line of the road, as it is stated several sites for the mills have already been selected. The company promoting the enterprise is composed principally of Little Rock people. Maxwell Coffin, vice president of the bank of Little Rock, is president; S. C. Dowell, of Walnut Ridge, Ark., vice president; Gordon N. Peay, of Little Rock, secretary and treasurer.

Louisville & Nashville.—Negotiations have been pending between eastern capitalists and the Louisville & Nashville R. on \$3,258,000 Louisville, Cincinnati & Lexington general mortgage gold bonds, interest reduced to 4½ per cent., the latter now being a part of the L. & N. system. Of the proceeds of the sale, \$2,850,000 will be used to redeem a like amount of the Louisville, Cincinnati & Lexington Co., maturing on January 1, the balance being covered into the treasury. In return for the treasury holdings thus sold, an equal amount of unified bonds, to be issued in place of the maturing Louisville, Cincinnati & Lexington first mortgage bonds, go into the Louisville & Nashville's treasury.

Mobile & Ohio.—The Montgomery, Tuscaloosa & St. Louis has passed into the hands of the Mobile & Ohio and it is to form a branch line of that road. The line is projected to run from Columbus, Miss., to Montgomery, Ala., traversing northwestern Alabama and giving the Mobile & Ohio connection with lines entering Atlanta, Ga., and Savannah. The new railroad also penetrates the coal fields of Alabama. The Montgomery, Tuscaloosa & St. Louis which is about 160 miles long, traverses the northwestern part of the state, terminating at Columbus, which is just across the line in Mississippi. It has no parallel line of railway, and passes through several counties which have no railroad whatever, although the famous Warrior coalfields extend into this section of the state. The line was originally promoted by J. W. Woolfolk, of Montgomery, who was the general contractor for the line. Before further steps could be taken toward completing the road the company went into the hands of a receiver. On Feb. 3 of the present year it was sold at foreclosure sale for \$300,000 and was bought in for the bondholders. At Montgomery the new road reaches the Western R. of Alabama, which, in connection with the Atlanta & West Point, forms the shortest route between Montgomery and Atlanta.

Newfoundland Railway.—A press dispatch from St. John N. F., states that the government has decided to purchase the Newfoundland R. for the sum of \$1,775,000. This

amount will be payable in bonds running fifty years and drawing three per cent interest. The railway company besides handing over its lines to the government, will relinquish all its claims to lands, minerals and timber within the colony.

North Carolina Ry.—The legal difficulties involved in the lease of the North Carolina R. by the Southern are by no means settled, and it is reported that Governor-Elect Russell has intimated that he will recommend to the next legislature the investigation and, if possible, the cancellation of the lease. The North Carolina was originally leased to the Richmond & Danville at an annual rental of \$260,000. A new lease, made in August, 1895, gives it to the Southern for 99 years at an annual rental of \$266,000 for the first six years and \$280,000 per annum thereafter. The state owns three-fourths of the \$4,000,000 stock, against which it has outstanding \$2,800,000 6 per cent bonds, which were issued to build the road.

Northeastern of Georgia.—According to press reports the legislature of the state of Georgia has authorized its governor to sell the Northeastern R. owned by the state and operated by Mr. R. K. Reaves, state agent. It is thought by many that the Southern will probably become the purchaser if the law prohibiting the purchase of railroads by competing lines will not operate in the case, as the road would secure valuable connections which the Southern desires, in connection with other properties of the Southern in Tennessee and Georgia. The minimum price to be accepted is \$287,000. The road is 39 miles in length and runs between Athens and Lula, Ga.

Oregon Short Line & Utah Northern.—The final decree for the sale of all the Butte and Boston securities by the receiver of the Oregon Short Line has been signed by Judge Knowles. Captain Couch's resignation as receiver was accepted, leaving Mr. J. T. Forbes as sole receiver. The sale includes the properties covered by the mortgage of the Massachusetts Loan & Trust Co. and other claims.

Richmond, Nicholasville, Irvine & Beattyville.—Another postponement for the sale of the Richmond, Nicholasville, Irvine & Beattyville has been announced and this time the date has been set for January 23 of next year. The sale will be made at Versailles, Ky., under decree of United States court to foreclose a mortgage. This is the third postponement, there having been no bidders at any date named. The road extends from Versailles to Irvine, a distance of 60 miles.

St. John & Lake Eustis.—On December 15 the gage of the St. John & Lake Eustis R. will be changed from narrow gage to broad gage. It is expected that the entire work will be completed in ten hours time with a force contributed by nearly every division of the Plant system. This railroad is about 50 miles long, and is one of the best feeders in the state for the Plant system. The main line of the road runs from Lane Park on Lake Harris around the south, east and north sides of Lake Eustis and the south side of Lake Griffin. It connects with the main line of the Plant system at Leesburg, forming a semi-circle, and passes through the country known as orange bend, famous for many years as an orange producing region. A branch runs also from Fort Mason almost directly north to Astor on the St. Johns river. It is one of the most desirable pieces of railroad property in the state. The road is being changed to facilitate the handling of fall and winter vegetables which are being planted on a large scale.

Sedalia, Warsaw & Southwestern.—The Sedalia, Warsaw & Southwestern R., which has been operated for the past two years and a half by Receiver Thomas F. Mitchum, will be restored next week to the Missouri Pacific. The road which is about 43½ miles in length was opened for traffic in December, 1880, and in the following August it was purchased by the Missouri Pacific. It is now stated that the original stockholders and the directory of the Missouri Pacific have reached an amicable understanding and the existing litigation will come to a conclusion satisfactory to all parties concerned in the circuit court, which convenes on Monday next at Sedalia.

Shelbyville Southern.—On December 4 the contractors of the new Shelbyville Southern (a branch of the Chicago & Eastern Illinois) completed the bridge over the Kaskaskia river at Shelbyville, and it is said to be the largest bridge in the state of Illinois. The structure is 1,400 ft. long and 108 ft. above the bed of the river, and is entirely of iron and steel with the exception of the piers. It is expected the new line will be entirely completed by the 15th of the present month.

Tennessee Central.—A tour of inspection of the Tennessee Central has been made by Receiver C. O. Godfrey, together with eastern capitalists, who it is said went over the line with a view to organizing a company to purchase the property. A conference of the parties at interest will be held in New York the first of next week, at which it will be decided whether the line is to be sold at court sale or not. In a report the receiver said that when he took charge of the line 21 miles of the grading and over one-third of the heavy tunneling were completed, that since that time he has constructed ten more miles of the line, about one-third more of the tunneling and other miscellaneous work. The road is projected from Monterey to Knoxville—100 miles—and Col. Godfrey says the entire project will surely be carried through. This road will penetrate the oil fields of Tennessee now attracting such attention.

United Counties.—Notice has been given by the sheriff of St. Hyacinthe county that on Jan. 26 next will occur the sale of the United Counties road, or that part of it extending between St. Robert and Iberville—a distance of 20 miles. The road will be sold by authority of justice on a judgment obtained by the Sisters of the Precious Blood.

NEW ROADS AND PROJECTS.

Missouri.—The contract for the 34 miles of new road necessary to connect the Quincy, Omaha & Kansas City road with terminus at Trenton with the Omaha & St. Louis terminus at Pattonsburg was let on the afternoon of the 7th inst. to Mr. Robert Gilliam, chief engineer of the Kansas City, Pittsburg & Gulf. The contract includes grading, laying of ties and rails, and the construction of bridges. The contract was not awarded in a lump sum, the price of each part of the construction work being stipulated. Work will be begun as soon as the weather will permit. The letting of this contract is another step in the execution of the Kansas City & Northern connecting railway scheme, and practically insures the consummation of that enterprise. The new line, which is to connect Kansas City with Pattonsburg, has been surveyed and the grading and laying of rails will be begun in the spring. The name of the consolidated lines will be the Omaha, Kansas City & Eastern. They will connect at Kansas City with the Pittsburg & Gulf, affording a new direct line to the Gulf of Mexico from Quincy, Des Moines, Chicago, and other great Northern cities.

A rumor is afloat that the St. Joseph & Grand Island is desirous of acquiring an entrance into Kansas City, and that part of its plan is to buy the Kansas City & Atlantic, which extends from Kansas City to Smithville, a distance of 20 miles, and then by the building of about 18 miles of new track to connect with the Chicago Great Western at Dearborn, gain the desired end by using the tracks of the Chicago Great Western or Santa Fe. The proposed route would be almost a straight line from St. Joseph to Kansas City, and would shorten the distance by rail between the cities about 20 miles. The new scheme contemplates the use of the half-built Winner bridge in getting into Kansas City.

North Carolina.—There is again strong talk of building an extension of the Norfolk & Southern south either from Elizabeth City or Edenton, its present terminus. The present line extends from Norfolk, Va., to Edenton, a distance of some 73 miles, and the proposed extension to Washington or Newbern would give good connections to Wilmington and the south. It is stated that a party of capitalists connected with the Norfolk & Southern and the New York, Philadelphia & Norfolk Cos., including the president, vice president and others of the last named road have been prospecting around Edenton recently with a view to locating the route for the proposed extension, which it is thought will be made without delay.

Ohio.—Articles of incorporation were, on December 5, filed with the secretary of state for the purpose of building a new road to be called the Dayton Northern and whose general offices will be at Lima, Ohio. The incorporation papers read that the company wants to build, acquire, own, lease, operate and maintain a railroad, to be operated by electricity, steam or other motive power, having Franklin, O., and Lima, O., for termini. It is thought that the same power which built the Lima Northern is behind the new move, and it means that if the Ohio Southern gets into other hands, the Lima Northern will be built to Cincinnati. The line, which would be from 125 to 150 miles in length, is regarded as a Brice move, and when executed the paralleling of the Cincinnati, Hamilton & Dayton will be effected. The incorporators are James B. Townsend, W. B. Richie, C. N. Haskell, Edward R. Thomas, W. C. Brown and J. R. Megrue. Capital stock, \$10,000.

Pennsylvania.—It is said that there is a good prospect of the extension of the Buffalo & Susquehanna from Ansonia, the present terminus, to Wellsboro, and thence to Towanda, to a connection with the Lehigh Valley. This it is thought, would put the road in a position to handle a large coal tonnage from the Lehigh Valley that the Beach Creek road now has.

The talked of extension to the Monongahela Connecting road, it is said will be a fact next spring. It will pass from the National Tube Works up the Youghiogheny along the river bank to the new galvanizing works at Versailles. This valuable five mile extension will connect up all the National Tube Works plants and allow the company to transport freight much better. The line which has been surveyed is a good one, and easy to traverse.

INDUSTRIAL NOTES.

Cars and Locomotives.

—The Colorado Midland will next week ask for bids on 100 box cars.

—The Chattanooga Southern is reported as being about to take bids on 50 new cars.

—Missouri Car & Foundry Co. gets the 1,000 B. & O. cars. They are to be built upon the same specifications as last order of 3,000.

—St. Louis & San Francisco order for 300 coal cars is definitely settled. Specifications were given out Dec. 4.

—The Grand Rapids & Indiana Railroad is reported as being about to add 70 more cars to its present equipment.

—The Weimer Machine Works Company, of Lebanon, Pa., is building a number of cinder cars for the Carnegie Steel Company, at Pittsburg.

—On the first of December, less than five per cent of the equipment on the Baltimore & Ohio was shopped for repairs.

—The Southern Railway has ordered four combination baggage and passenger cars of the Pullman Co. These cars have six wheel trucks, and are equipped with the McKee, Fuller & Co.'s wheels.

—The Armour Packing Co., of Kansas City, which was referred to some time ago as being in the market for

additional equipment has contracted with the St. Charles Car Co., for 100 refrigerator cars.

—The Haskell & Barker Car Works, Michigan City Ind., has announced the resumption of work in all departments. The works will run day and night after December 25, and 1,000 men will be given employment.

Bridges.

—The secretary of war is reported to have approved the plans of the proposed wagon and motor bridge across the Missouri river at Boonville, Mo. Committees have been appointed to raise the stock. The estimated cost of the bridge is about \$200,000. The plans were said to have been prepared by A. J. Tullock, proprietor of the Missouri Valley Bridge & Iron Works, Leavenworth, Kan.

—The Chesapeake & Ohio Railway Co. is making arrangements for reconstructing the bridge at Manchester, Va., and for making other improvements to its lines.

—Bids are being asked for the superstructure of the West Braddock bridge over the Monongahela river at Pittsburg. The bridge consists of one span 490 ft., one span 518 ft., one span 255 ft., and about 1,100 ft. of viaduct approach. Wilkins & Davison, Pittsburg, Pa., are the engineers. Geo. W. Wilson, Max G. Leslie, R. H. Douglas Geo. H. Stengil, Harvey A. Lowry and Dr. John P. Sterrett have been appointed a committee by the council at Pittsburg, to make arrangements for the construction of new bridges at Penn, Shady and Highland avenues to cost about \$34,000, of which amount the Consolidated Traction Co., is expected to pay \$20,000.

—The construction of a new bridge over the Platte river at Denver, Col., is being agitated by the supervisors and the board of public works. Supervisor C. S. Phister can be addressed. The board of public works on December 21, proposes to advertise for bids for the construction of a viaduct at 14th street. Plans and specifications have been prepared for this structure which will be about 3,480 ft. long and is to cost about \$200,000. The Paonia Bridge Co. has been incorporated by T. C. Wand, H. L. Curtiss, F. H. Bullen and N. L. Hollister, to build a bridge over the North Fork of the Gunnison River, in Delta county.

—The Youngstown Bridge Co., Youngstown, Ohio, has the contract for a double track plate girder bridge on the Pacific & Western Railway, a cast house for the Youngstown Steel Company, besides a numerous other smaller jobs, including a large number of crane girders. They have just finished a number of bridges for the Pennsylvania Co.

—The Buffalo, Rochester & Pittsburgh Railroad Co. will build a heavy bridge over Cattaraugus Creek near Springville, N. Y. It will be 150 ft. high.

—The new commissioners' court at Sherman, Tex., has advertised for plans, specifications and bids on three new steel bridges to take the place of wood structures at once.

—The Glendon & Gulf Railway, now building an extension of its line to Charlotte, N. C., from Glendon, Chatham county, will during the next year contract for several iron bridges across streams and also for considerable trestle work.

—F. M. Turner, city engineer of Dayton, O., on November 27 submitted estimates to the board of city affairs for two new bridges across the Miami river, one at Main st. and one at Third st., the first to cost complete \$138,000, and the second complete \$158,000. The board has not yet decided whether to call a special election in the matter or wait until the spring.

—The city engineer of St. Paul, Minn., has prepared plans for a steel bridge over the tracks of the Chicago, Milwaukee & St. Paul Railway Company at Summit ave. The structure will be 60 ft. long and 100 ft. wide and is estimated to cost \$28,500. This bridge is to be constructed by the railway company.

—Bids are asked until January 14 for repairing the entire wooden bridge and approaches over the South Umpqua river at Roseburg, Ore. The work is to be completed about Aug. 1, 1897.

—The council has directed the board of public works to prepare plans and specifications and to advertise for bids for constructing an iron bridge and abutments over Cazenovia Creek at Cazenovia street, Buffalo, N. Y.

—The Lewiston (Idaho) Water & Power Company is making surveys for proposed Snake river bridge. Soundings for location—as to bedrock—will be taken as soon as the water gets low enough. It is hoped to put in piers during low water the present season.

—The construction of a bridge at Clark avenue, St. Louis, for which the railway companies are asked to contribute about \$150,000 is being agitated.

Buildings.

—The Schenectady Locomotive Works intends to erect a new brick building 200 x 80 ft., which will be used for the manufacture of tanks.

—The enlargement of the Louisville & Nashville Railway shops at Decatur, Tenn., is being considered.

—The contracts have been let for the erection of a new car repair house at Keyser, W. Va., for the B. & O. R. R. The structure will be 80 x 420 ft. and cost about \$10,000.

—Bids will soon be received by Mr. W. T. Manning chief engineer Baltimore & Ohio Railroad Co., for erecting an addition to the Camden station in Baltimore. The addition will contain waiting, dining, smoking rooms, etc. and a train shed 146 x 60 ft. Alongside of this station there will also be erected another shed from which trains will leave.

—The Chesapeake & Ohio Railroad will erect a freight depot on Second avenue and Ninth street, Huntington, W.

Va. It is said that they will also erect a \$40,000 passenger depot at that place.

The city authorities of Paterson, N. J., propose to ask the Erie Railroad to erect a new railroad station at that place.

It is authoritatively stated that the Burlington would proceed at once, acting independently of all other roads, to build a depot at Omaha, Neb., on its property at Tenth, Mason and Pacific streets.

Plans have been prepared by Architect J. F. Warner, for the new depot of the Lehigh Valley Railroad to be erected at Rochester, N. Y.

The new shops of the Kansas City, Pittsburg & Gulf road at Shreveport, La., has been completed. They are constructed principally of brick and include a machine shop 100 x 263 ft., a car repair shop 85 x 230 ft., also a roundhouse. The main shop is equipped with a 400 horse power engine and a full outfit of machinery. The entire plant cost about \$125,000.

The freight depot being built by the Seaboard Air Line in Atlanta, Ga., will be completed about January 1. It is one of the largest freight stations in the country. The building is 656 ft. long, with an average width of 125 ft. The two ends, the street wall and a two story section of the depot are of brick. The railroad front is of heavy galvanized iron. The roof rests on steel truss work, which is supported by steel girders six feet wide, resting on lattice columns of steel. The warehouse space is 125 x 206 ft. The two story section, which comes next, 56 x 141 ft., and contains freight offices. The farther end, with a space 125 x 400 ft., will be used as a freight depot by the Western & Atlantic Railroad. The north side has thirty-two doors, wide enough for a dray to load or unload. The retaining wall to the left of the roadway is over 700 ft. long and in places twenty feet high and several feet thick. This road will shortly make extensive improvements to its shops at Portsmouth, including erection of new building for boiler shops; new machinery has recently been added.

The Pittsburgh Bridge Co., has been awarded the contract for the structural work on the new building for the General Electric Co., Schenectady, N. Y. The building will be 100 x 236 ft. The company has also received a contract for the new Monongahela connecting bridge, work upon which will begin at once.

Work is about to begin on the depots to be built by the Louisville & Nashville at Montgomery, Ala. The passenger station is to be built of brick, with stone trimmings. It will be three and four stories high, and contain commodious waiting rooms, ticket offices, baggage rooms and restaurant on the ground floor, with apartments for the officials above. In connection with it will be a train shed of iron, to be 600 ft. long. The freight depot will be 50 x 545 ft. and adjoining the passenger station. It will be constructed of brick.

Iron and Steel.

The Ohio Steel Company of Youngstown states that the report that it will abandon the manufacture of Bessemer steel and will erect a number of open hearth furnaces and also begin the manufacture of steel rails is not worthy of any attention. The directors have voted to increase the capital stock from \$1,250,000 to \$2,000,000.

The changes to be made to the plant of the Cleveland (O.) Steel Company consist of two open hearth furnaces of a new type. The company will cast its own steel, copper and brass ingots, which will be rolled down into plates and sheets of the highest grade. It is the intention to cast small ingots or slabs, and the necessity of blooming down will be obviated. Under patents taken out by John A. Potter, superintendent, it is expected that these slabs, which will be 3x24x24 in., will be cast in the absence of air and a uniform fibrous steel secured, avoiding piping, segregation, and other defects which it is difficult to combat under present practice.

The works of the American Tube & Iron Company at Middleton have been running better since the election and a good business for December is reported. The affairs of the company are being gotten into excellent shape, and last week another payment of 5 per cent on the original indebtedness was made by the receivers.

Eventually the Lower Union mills of the Carnegie Steel Company, Limited, at Twenty-ninth street, Pittsburgh, will be removed to Duquesne, and the Upper Union Mills at Thirty-third street, to Homestead, Pa. Nearly all the available river frontage lying between Homestead and Duquesne has been secured by the Carnegie Steel Co. Ltd., and is to be utilized for the above plants and also for additions to Homestead and Duquesne steel works. It is also likely that before a great while the plant of the Keystone Bridge Works at Pittsburgh, will also be removed to Homestead. It is the aim of the Carnegie Steel Company, Limited, to concentrate their various plants as much as possible. One of the largest shipments from the Pittsburgh district was made a few days ago by the Carnegie Steel Company from the Thirty-third street works. It consisted of 20 car loads of channel bars, bands and I beams, and was consigned to Cramp & Sons of Philadelphia.

The death of Mr. McDonald, president of the St. Joseph Bar & Axle Company, manufacturers of merchant bar iron, car axles, etc., will prevent the opening of that company's works by the present organization. Steps are being taken, however, by Vice President Geo. T. Walker, looking to reorganization and the reopening of the plant. He has some stock already pledged and believes he could easily complete subscriptions from local capital if some practical man with means were joined with him in the enterprise. The works are admirably equipped, it is said,

for making merchant bar from billets, axles, etc., very cheaply. That section of the country can furnish all the scrap needed at eastern rates less the freight and there is an ample market for the product at eastern prices, freight added. Mr. Walker would be glad to communicate with interested parties in regard to the entire matter.

Machinery and Tools.

The Vulcan Iron Works, Chicago, has recently received an order for a large steam dredge for the Illinois Terra Cotta Lumber Co. of Pullman, also new cast steel tracks, racks and pinions for the Wells street bridge and cast steel brackets for the Lake street bridge, Chicago. They are also figuring on a large quantity of other heavy work.

Heyl & Patterson, Pittsburgh, has lately shipped two carloads of coalhandling machinery to the Dominion Coal Co. in Nova Scotia, and has just finished the work of remodeling the coalhandling plant of the Schoenberger Steel Co. The firm has received an order from the St. John (N. B.) Railway Co. for a system of coke crushing, elevating and conveying machinery.

The Lodge & Shipley Machine Tool Co., Cincinnati, O., has made important improvements in its plant during the year. Twenty-six new machine tools have already been installed, besides a complete electric light equipment, and are out at the present time for four more machine tools, which it is hoped will be installed before January 1.

The Lidgerwood Manufacturing Co., New York City, states that the machinery now in use on the Panama canal consists of seven standard Lidgerwood cableways with steel towers aerial dump, similar to those employed on the Chicago drainage canal. The cableways are not traveling, although the company strongly urged them. The cableways are used for the purpose of handling earth from cars in the bed of the canal to hoppers arranged over cars on the berm. The material excavated has all to be hauled some distance and cannot be wasted on the berm; it is necessary to employ some sort of device for taking the loaded skips from the canal and delivering them to the cars, and the cableway was adopted for that purpose. These cableways were set up entirely under the direction of the company and have been completed and satisfactorily tested.

The Colorado Iron Works Co. of Denver, has received an order from the Mazapil Copper Co. of Saltillo, Mex., for three latest improved elliptical bowl slag trucks, and also for one double pot slag truck for the Compania Minera Fundidora y Afenadora al Monterey, Mexico. It has recently shipped a 6,200 ft. Finlayson patent wire rope tramway to the Noble Five Mining & Milling Co. at Daudon, B. C.

The Virginia Iron Works, Norfolk, Va., has replaced its old tools by new improved, up to date machinery in every department. It is also put in a Calliau cupola of latest design. These additions will enable it to execute a larger amount of work and with greater expedition than previously.

Thos. Carlin's Sons, Allegheny, Pa., has received an order from an eastern contractor for a large stone quarry plant, including steel drums, cars, rope, etc.

The manufacture of air compressors has been begun by the Curtis & Co. Manufacturing Co., St. Louis. The success of its undertaking is attested by the fact that the company has been compelled to run nights to complete a number of compressors for urgent customers. The company now has orders for three 8x8 air compressors—one of them for the Bass Machine Works, Ft. Wayne, Ind. This Curtis air compressor is entirely automatic. The company expects to manufacture these air compressors extensively, but not in the largest sizes, confining itself principally to compressors suitable for the purpose of air hoists, sand blasts, pneumatic tools, etc., and is now fully equipped to fill orders in this department.

Miscellaneous.

A writ of attachment for \$12,000 has been served upon the trustees of the Rhode Island Locomotive Works of Providence, R. I. The action is brought by the Midvale Steel Company, of Philadelphia, who claim that it is impossible for them to give further time to the Rhode Island corporation. The financial depression of the last year is said to be the cause of the difficulties in which the company has been placed.

The American Brake Beam Co., of Waukegan, Ill., has added a new department to its factory for the manufacture of car roofing. The machinery for this purpose was removed recently from Cragin, Ill.

The Chicago Shipbuilding Co. has closed contracts for three new vessels, two steamers and a tow barge; the aggregate cost of which will be close to \$400,000. Work on the new boats is to be commenced immediately, and it is expected that they will be launched not later than June 1, 1897. The steamers are to be duplicates of each other, and of a type not at present common on the great lakes, and will be of greater beam and depth than the ordinary boat. The steamers are to be built for Mr. R. R. Rhodes, of Cleveland. They will be constructed entirely of steel, and their machinery equipment will be such as to make them among the fast steamers of the lakes.

The sheriff has seized the bridge works of the Cofrode & Saylor Co., of Pottstown, Pa., for debts aggregating \$140,000. The company also operates big iron works at Reading. The bridge works were seized at the instance of the bondholders, and the seizure is to assist in a reorganization plan.

In the circuit court of St. Clair county, Illinois, Judge Wilderman finds that the North & South Rolling Stock Co. is insolvent and appoints Charles Becker of Belleville, Ill., as receiver, with directions to take possession of all the property and assets of the corporation. The re-

ceiver is also directed to apply at once to the United States circuit court for the southern district of Illinois for an order to release and turn over to him the property of the company, consisting of 700 freight cars, which are now in possession of a receiver duly appointed by the United States court. This action was taken to enforce the collection of judgments for over \$63,000 lately obtained by the city court of East St. Louis.

The Milwaukee Automatic Car Coupler Co. is the name of a corporation now being organized in Milwaukee for the purpose of pushing the manufacture and sale of the Runkel automatic car coupler, the invention of John P. Runkel, of Milwaukee.

The King Bridge Co., of Cleveland, has been awarded the contract for putting in a 60-foot iron turntable for the Vandalia Line, at Terre Haute, Ind.

The A. French Spring Co. is at work on an experimental order for huge springs, the purpose of which is to "take up" the recoil of the fortification and battleship guns after discharge. Experiments so far made indicate success to a degree which gives promise of future large orders for springs for this purpose, and as well for the huge 125 guns used at the coast defense forts.

A verdict was reached November 17, at New Philadelphia, O., in the suit of the Wrought Iron Bridge Co., Canton, O., against J. B. Clow & Sons, of Newcomerstown, O., and Chicago. The suit was brought to recover judgment for over \$13,000 and interest due it for building the iron framework for the pipe foundry building at Newcomerstown. The defendant claimed \$30,000 damages by reason of the bridge company not completing its contract by the time specified in the contract. After hearing the testimony the court directed the jury to bring in a verdict for the bridge company for the full amount of its claim, which was done, the verdict being for \$14,223.15.

The Standard Car Truck Company of this city has secured the services of W. D. Lacarle as sales agent. Mr. J. C. Barber is at the head of the company and it is the intention to in the very near future, launch upon a vigorous campaign in the manufacture and sale of what is at the present time well known as the Barber truck.

Mr. W. E. Bushnell, after having been for 15 years in charge of a department with Fairbanks, Morse & Company, has resigned his position as manager of the railway department which he has held for ten years past and on the first of January, will take general charge of the shop and office of the Kalamazoo Railroad Velocipede & Car Company at Kalamazoo, Mich. Mr. H. G. Haines will still hold the position of secretary and general manager and it is the intention to materially widen the scope of the business of the company in old and well established lines and also in new ones which will be established. The company is to be congratulated on having secured the service of one who has had so wide an experience in this branch of the railroad supply business as Mr. Bushnell.

The Union Switch & Signal Co., according to a communication recently received from Mr. V. Spicer, signal engineer and western agent, has a large amount of work on hand in its western district. On the Northern Pacific Railway 93 active levers are now being installed at four plants between St. Paul and Minneapolis. At the Grand Junction crossing of the Chicago & Northwestern with the Chicago, Rock Island & Pacific Railway a plant is being installed having 18 levers and two spaces. This is being equipped with electric locking. At Jeffersonville, Ind., a fifty lever machine having 6 spaces is under construction for the Pennsylvania Company. A 24 lever machine with six spare spaces is under construction at the crossing of the Pittsburgh, Cincinnati, Chicago & St. Louis with the Cincinnati, Hamilton & Dayton Railway at Piqua, O. At Dalton, Ill., a machine of 161 levers and all spare spaces is being installed for the Hammond & Blue Island Railway, at the crossing of that road with the Chicago & Grand Trunk, Chicago & Eastern Illinois Railway and the Pittsburgh, Cincinnati, Chicago & St. Louis Railways.

This company has received the following orders: A machine of ten levers and two spare spaces, for the Union Pacific Railway, at Sandy Creek; for the Illinois Central Railway a 13 lever and 7 space machine at South Centralia, and another machine of 24 levers and 4 spaces to go to another point on this road. Material has been ordered for a 16 lever frame machine for a plant which is to be erected by the Chicago, Rock Island & Pacific Railway at Camforth. This machine is to have electric locking and annunciators. Material has been ordered for a 28 lever machine for the Fifty-fifth street crossing in Chicago on the Chicago & Western Indiana Railroad. A contract has been taken for additions to the plant at Forty-ninth St. on the C. M. & St. P. Ry., and also the old Calumet Park plant is to be rebuilt with 73 levers and 19 spaces, the additions being made necessary by the crossing of the H. & B. I. R. R. A large order has been taken for all of the interlocking material for a machine of 98 levers and 46 spare spaces which is being erected by the Illinois Central R. at Burnside, the construction being done by Mr. W. J. Gillingham, signal engineer of the road. In addition to this list there are several small orders for material, and in the line of electric signaling it should be stated that on November 28 this company put into service a very complete system of block signals on the Michigan Central Railroad between Niles, Michigan and Michigan City, Indiana, which in addition to those between Jackson and Dexter, Michigan comprises a large automatic block signal application. Judging from a large number of plants which are at the stage which requires estimates, an indication is seen of excellent business prospects for this company in the west, entirely aside from the work which is being done in the east which is not included in these notes.